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AND RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,

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APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.
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On February 7th.—446 to 458.—A. Prince. Mechanism to be employed for packing into parcels tobacco or similar and like substances (com. by F. Flinsch).—R. Brown. Stop valves or taps.—J. Robertson. Motive-power and blowing engines, parts of which are applicable to meters for measuring liquids.—T. G. F. Dolby. Apparatus for saving life at sea.—S. W. Maquay. Furnace retorts and mode of employing the same —R. Jones. Improved Davy's safety lamp.—W. R. Lake. Valves and parts connected therewith for direct-acting steam engines (com. by G. F. Blake).—A. Guattarri. Pneumatic telegraphs.—W. R. Lake. Valves and parts connected therewith for direct-acting steam engines (com. by G. F. Blake).—J. Shaw. Heating, applicable to the exhausting of the steam from the cylinders of steam engines, steam hammers, and other like apparatus.—J. H. James. Ornamental surfaces.—W. Fletcher. Obtaining motive power, propulsion of tramway carriages and other uses, and means or apparatus employed therein.—A. Lafargue. Production of gas or vapour from hydrocarbon oils or combinations thereof with other matters, and means or apparatus employed in utilizing the same.

On February 8th.—459 to 473.—G. Haseltine. Hoes (com. by M. Cookerly). (Complete specification).—J. Roddis. Chimney cowl.—A. Prince. Mechanism or apparatus to be employed for distributing colour upon continuous or endless lengths of paper or other material (com. by F. Flinsch).—C. U. Collins and J. Arnot. Lock and latch furniture.—W. H. J. Grout. Wheels for carriages, velocipedes, and other vehicles for common roads.—W. J. Schlesinger. Machines for seeding or stoning raisins (com. by C. Dixon).—W. J. Schlesinger. Universal tool or implement, chiefly designed for warehouse and household purposes (com. by W. L. Grout).—T. Gratton and J. Beal. Wheels and tires for railways.—J. King, J. M. King, and T. D. M. King. Apparatus applicable to railway platforms to prevent persons entering and leaving trains in motion, and for other such like purposes.—J. King, J. M. King, and T. D. M. King. Coupling for repairing propellor shafts at sea. G. F. Parratt. Life rafts.—J. W. Hadwen and A. Randolph. Machinery or apparatus for spinning wool, cotton, silk, flax, or other fibrous substances.—T. C. Fawcett. Brick-making machines.—H. Tasker. Machinery for elevating corn, hay, and other agricultural produce.—W. R. Lake. Apparatus for producing an equal distribution of heat in the tubes of locomotives and other similar steam boilers (com).

On February 10th.—474 to 491.—R. Werdermann. Reducing metals from their ores and purifying and refining the same. (Complete specification). —C. H. Bayley and John Cheetham. Machines for combing cotton and other fibrous substances. —R. Werdermann. Mode of and apparatus for purifying and refining metals and alloys.—A. T. Fullicks. Securing a foothold on roads, footways, platforms, stairs, and other like surfaces. —A. Storry. Rivetting machines employed in the manufacture of boots and shoes.—C. Sipriot. Apparatus for exhibiting placards, posting-bills, and other advertisements.—W. Pilling and B. Harlow. Stench traps and grids for street and other sewers or drains.—J. Pinker. Lowering and raising ships' boats and the apparatus employed therefor.—J. H. Kenyon, W. Taylor, and J. Kenyon. Apparatus for economising steam for drying yarns and fabrics.—J. Milburn. Chimney cowls.—V. Daelen. Wheel tyres and other similar hoops or rings.—G. T. Yull. Apparatus or appliances for clearing and removing snow, slush, and other débris from tramway tracks and grooves and from roadways in general, also appliances for facilitating the sanding of such tracks and roadways.—H. A. Bonneville. Presses, and the means of ascertaining the power exerted by said presses (com. by G. Martin.) (Complete specification).—W. Wilson. Hats (com. by R. Eickenmeyer).—W. Knaggs. Fire-places.—J. H. Reynolds and J. Reynolds. Guiding apparatus for keeping railway engines and carriages upon their rails.—A. M. Clark. Railway signalling apparatus (com. by P. T. H. Lartigue and P. D. Prud'homme).—J. B. Rogers. Rockets, signals, guns, means and appliances for propelling the same.

On February 11th.—492 to 509.—H. G. Cardozo. Horses' shoes, to enable and ensure a horse's safe and quick travelling in either frosty or slippery weather.—H. M. Lee. Preserving ferns, plants, and grasses, and the preparation of the material or materials and ingredients employed therein.—J. Briggs, and R. Willan, and D. Lewis. Sizing or dressing machines.—W. C. Nangle. New or improved composition, or paint to be used for coating metal and other substances.—J. Stone. Flues for furnaces.—D. Fisken. Rope parters for steam ploughing machinery.—W. Gascoyne. D traps for water-closets and other like purposes.—G. F. Chantrell. Apparatus for storing, cleansing, and facilitating the removal of "house refuse" and fœcal matter. —J. Cowen. Apparatus for heating green-houses and horticultural and other buildings.— A. M. Clark. Sewing machines (com. by C. R. Goodwin).—A. Debenham. Undershirts and flannel and other waistcoats.—L. D. Newell. Ships' berths and sofas.—J. Norris. Mathematical drawing instruments.—H. Deacon. Manufacture of chlorine.—S. Bash. Bobbins.— W. Gilchrist and M. Thomas. Bricks, tiles, and other similar articles, and in the machinery or apparatus employed therefor.—W. T. Siddons. Apparatus for preventing the overwinding of skips in the shafts of mines.—J. Salleron Corks, and apparatus employed therein. (Complete specification.)

On February 12th.—510 to 528.—F. L. Lawrence. Apparatus to be used in boilers for washing or cleansing clothes and similar purposes (com. by C. Lawrence).—S. W. Maquay. Process to be employed in the manufacture of manures, and machinery or apparatus therefor.—S. Myers. Stoves and grates for the purpose of saving coal and other fuel, and giving greater amount of heat than can be obtained from the stoves and grates now in common use.—H. Campbell. Utilization for manurial purposes of certain chemical vegetable, and animal products and animal excreta.—W. Newell. Ornamenting certain articles or parts of articles made of tin plate, and apparatus to be used for that purpose.—J. Broad. Case or bag for applying poultices and other external applications to various parts of the human body.—G. Haseltine. Apparatus for adjusting the screw propellers and rudders of canal boats and other vessels (com. by J. M. Dodge).—W. Campion and W. Campion. Mode of turning the welts of knitted or looped fabrics, and instruments to be employed therefor.—W. Richards. Machinery and apparatus for charging and drawing retorts used in the manufacture of gas.—J. C. Ramsden. Means or method of and apparatus for transmitting heat from furnace or other dry heated gases to atmospheric air or to other gases.—A. Barff. Utilization of heat (com. by J. Kidd).—J. H. Johnson. Automatic regulating valves (com. by G. L. Kitson and G. W. Carr).—J. H. Johnson. Lawn-mowing machines (com. by E. G. Passmore).—R. Lyon. Apparatus for communicating between the passengers and guards, and between the guards and engine-driver of a railway train.—W. Brown and J. Johnstone. Ploughs operated by steam, hydraulic, or other mechanical motor, and apparatus used therewith, being also applicable for other cultivating operations.—C. Sholl. Atmospheric hammers, and apparatus connected therewith.—S. H. Emmens. New and improved construction of railway for locomotive purposes.—J. Jeffs. Mechanism or apparatus to be employed for ironing and glazing textile fabrics, paper, or other similar and like substances.—C. W. Harrison. Obtaining oxygen.

On February 13th.—529 to 546.—J. Wyatt. Apparatus for signalling between the different parts of railway trains, and applicable also as a general alarum.—J. T. Dennison. Construction and arrangement of domestic fire-places, flues, and grates for economizing fuel and space, also reducing first costs of construction.—W. J. Dunderdale and T. M. Holt. Tables.—J. Armstrong. Wheels for railways and for other uses.—G. Ermen. Apparatus for economizing fuel in house fire-grates.—C. Owen. Electrical intercommunication between passenger and guard, guard and guard, and guard and engine-driver.—A. J. Parker. Machines for printing.—S. Marsters. Means and apparatus for cooling beers and other liquids.—S. Alley. Dressing shirts, and apparatus therefor.—C. Burfitt. Composition for the removal and prevention of incrustation in steam boilers.—J. Noad. Manufacture of sulphurated lead, apparatus therefor, and its application to various useful purposes.—W. R. Lake. Machine for sewing sails, tents, tarpaulings, awnings, and similar articles (com. by K. C. Barton).—E. Edwards. Construction of engines driven by steam, compressed air, or other elastic fluid, or by water, especially applicable to rock-boring engines.—A. McDougall. Stable manure and for obtaining useful products therefrom.—J. Viault and C. N. Bernier. Electric detonating disc and other signals for preventing railway accidents, applicable to railways.—G. C. Ash. Hats and coverings for the head.—H. Highton, M.A. Electric telegraphs.—J. S. Crabber and W. Mellor. Machinery or apparatus for smoothing and pressing textile fabrics.

On February 14th.—547 to 558.—J. G. Willans. Manufacture of iron and steel.—Phil. Dr. K. L. H. Gercke. Composition of cartridges for breech-loading guns, with a new form of bullet and a greased pasteboard bullet-cup to prevent fouling.—H. Kershaw. Spinning.—F. G. M. Stoney. Sluices or stop-valves.—D. Hutchinson. Removing and preventing incrustation in boilers.—J. Adams. Apparatus to be applied to steam or hot-air engines for using the air expansively.—A. V. Newton. Extension ladders (com.)—W. H. Shepherd and J. Scott. Combing wool and other fibres.—A. Chappell and J. Charlesworth. Apparatus for feeding wool or other fibrous material to carding or other machines of a like class.—F. H. Atkins. Filtration of water, sewage, and other fluids, whereby manure and other valuable products are separated, precipitated, and obtained therefrom.—J. H. Johnson. Manufacture of nut blanks, and in machinery and apparatus connected therewith.—W. R. Lake. Multiple crank apparatus for drilling, boring, or similar operations (com. from C. F. Ritchell.) (Complete Specification.)

On February 15th.—559 to 579.—W. H. Gillespie. Instantaneously arresting the motion of tramway cars.—W. R. Lake. Blast furnaces (com. by F. Buttgenbach.)—H. C. Attwater. Supply and stop valve.—T. A. Rochussen. Manufacture of iron and steel, and apparatus employed therein (com. by R. Daelen.)—C. Pengilly. Cleansing streams of water, and treating the deposit. (Complete Specifiation.)—W. A. Gilbee. Manufacture of fishing and other nets, and in the machinery or apparatus therefor (com. by M. Procopé.). (Complete Specification.)—W. Vincent. Fuel for heating and illuminating purposes.—W. Lee, junior. Roller blind movements or furniture.—R. Cockshott. New or improved oil or lubricant.—G. Greenwood, T. Saville, and J. Morton. Means and arrangements for heating rooms or buildings.—J. Patison. Destructive distillation of coal and shale for the production of illuminating gas, fuel, and oil, and other products therefrom, and in the apparatus therefor.—H. Y. D. Scott, Major-Gen., C.B.—Deodorization of excreta and in the manufacture of manures therefrom.—T. W. Miller. Ordnance and breech-loading small arms.—W. Darling and R. Sellers. Means of apparatus for cleaning, trimming, or dressing the teeth of wheels and of racks.—W. F. Baker. Manufacture of hats, caps, and bonnets (com. by A. Bogardus.)—J. Moorhouse. Fire ranges.—J. Lewis. Fire-grates or stoves, and in cooking, baking, and heating apparatus.—S. H. Emmens. Apparatus for producing heat and light.—W. W. Harrison. Knives and forks and handles.—E. Wood. Steam engines.—T. McBride. Manufacture of gold and silver cord used for military trimmings.

On February 17th.—580 to 590.—J. Quin. India-rubber valves.—A. B. Verrier. Warming rooms or buildings.—A. Barker. Clog irons and machinery for making the same.—W. Owen and J. Hill. Stove grates and appliances connected therewith for absorbing and diffusing heat.—W. Ritchie. Screw presses.—W. Greenwood. Machines for sweeping streets and highways.—D. Halmshaw. Fire-places or ranges, ovens, and boilers for domestic use, for radiating heat and economising fuel.—T. Cattell, M.D. Purifying gutta-percha.—A. J. H. Hutchins. Spicing and preparing malt or distilled vinegar, rendering the same better suited for pickling purposes.—W. S. Carmichael. Construction of ships and vessels.—L. R. Bodmer. Artificial stone, and the machinery and apparatus connected therewith, which improvements either wholly or partially are applicable for preparing and for compressing clay, coal, and other substances or compounds.

On February 18th.—591 to 611.—A. C. Henderson. Purifying water, or apparatus for purifying water chemically and mechanically; first, before its introduction into steam generators; second, before employing it in the different industries of dying, bleaching, or scouring, in the manufacture of paper pulp, distilling, and manufacture of chemical products; and, third, before use in domestic purposes, together with the apparatus therefor.—E. Marsland. Rollers for agricultural and other purposes.—J. Starkie. Economising fuel for domestic or other purposes.—J. H. Lee and C. Pringle. Preventing the destruction of boilers and engines by galvanic action. (Complete Specification)—J. Jackson. Apparatus or means for attaching discs to ropes and for preventing the slipping of ropes in passing over or round drums.—W. Sambrook. Heating the feed water of steam boilers and in apparatus employed therefor.—J. Shaw. Machinery and apparatus for punching and shearing.—J. J. Aston. Paddle propellers.—C. W. Sutton. Combinations of ingredients for removing acidity from ales, beers, porters, wines, &c., and also to preserve them from acidity.—J. Pain. Rockets, lights, and projectiles for giving distress and other signals at sea or elsewhere.—J. Marshall, H. D. Marshall, and C. Marshall. Straw-shaking apparatus of thrashing machines.—H. Jensen. Coke ovens, and the utilization of heat resulting therefrom (com.)—W. Minshall, and B. Dunkerley. Apparatus for felting hat bodies or other felted fabrics.—G. Turner, and J. C. Baldwin. Machinery for preparing, combing, and finishing wool and other fibres.—E. Rolin. Weighing machine.—A. M. Clarke. governors (com.)—G. Noble. Treating fibrous materials for the manufacture of pulp for paper.—A. V. Newton. Printing presses (com.)—D. NcC. Smyth. Sewing machines.—H. E. Forrest. Finishing metallic axle blanks. (Complete Specification.)—E. Clark, C. E. Machinery for raising and lowering ships and vessels. (Complete Specification.)

On February 19th.—612 to 628.—W. M. Brown. Looms (com.)—C. R. Western. Band saws.—C. Chanel. Improved fuel.—W. de W. Abney. Photo-mechanical printing and apparatus to be used in such printing.—S. Rickard, and E. Foster. Domestic fire-places for radiating heat and economising fuel.—J. Lightowler and J. R. Best. Kitchen cooking grates or ranges.—H. Wilde. Machinery and apparatus for producing, regulating, and directing electric light, part of which is applicable to other purposes.—D. B. Findlay. Apparatus for raising sunken ships and other submerged bodies.—H. F. Shearman. Journal boxes (com.)—W. Payton. Safety and relief valves.—E. B. Ellington. Hydraulic hoists.—H. Chamberlain. Manufacture of mortar, beton, and concrete.—C. Fowke. Sewing machines.—F. Sanders. Communicating or signalling on railway trains, and in warming railway carriages (com.)—E. Korting. Steam jet apparatus and air condensers.—T. J. Smith. Means and apparatus for producing ice and cold for refrigerating purposes (com.)—J. M. Stanley. Arrangements for generating and applying heat in rotary and cylindrical puddling and other furnaces.

On February 20th.—629 to 652.—P. F. Michaud. Axle-tree boxes and muffles for carriages and vehicles, for transmitting shafts, and all parts of machinery having a rotary motion, and the mode of construction thereof. (Complete Specification.)—W. Goodwin. Two-wheeled carriages.—J. Spencer and J. Consterdine. Weighing machines.—W. Wyatt. Corn meter for measuring and registering the supply of corn or grain.—D. Gardner. Inlaid flooring, which may also be adapted for ornamenting surfaces other than floors.—W. R. Lake. Apparatus to be applied to steam boilers for burning liquid fuel (com.)—W. R. Lake. Steam boilers and their furnaces and apparatus connected therewith (com.)—J. C. Browne. Apparatus for lowering and disengaging boats from ships and vessels, also for hoisting boats.—C. C. Pilon. Manufacture of pouches, cases, purses, and boxes for holding tobacco, fusee or other lights, cards, bills, and documents generally, also money or other articles and things.—J. S. Gabriel. Machinery for sawing stone.—G. Lancaster and W. W. De la Rue. Apparatus or marking-board to be used in scoring games.—R. J. Fremlin. Purifying fusty and otherwise impure casks, and in seasoning new casks and timber to be made into casks.—T. Bell. Foundry or cupola furnaces.—W. G. Martin, Major, R.A., and R. E. R. Martin. Artificial fuel.—C. Topham. Stoves and fireplaces and chimneys and flues.—B. W. Farey. Valve gear of steam and other motive-power engines.—J. Webster. Applying gases or vapour to the refining and purifying of metals and apparatus to be employed for that purpose.—J. Caton. Construction and arrangement of domestic and other fireplaces, whereby the fuel used in the said fireplaces and the heat obtained therefrom are greatly economized.—J. Mercer, and S. K. Worthington. Looms for weaving.—W. W. Smith. Working and stowing anchors.—F. Broughton, R. Stephens, and G. A. Bradley. Locking railway signals and points.—M. Henry. Mode of and apparatus for treating marine plants known as sea weed, sea wrack, and algae (com.)—M. Henry. Mode of and machinery or apparatus for preparing fibrous materials for being spun (com.)—G. A. Simmons. Barometers.

On February 21st.—653 to 667.—T. P. Cooper. Simultaneously closing and fastening railway carriage doors.—J. M. Stanley. Arrangements for utilizing the waste heat in the flues of boiler and other furnaces.—J. D. Shakespear. Harmoniums, American organs, and similar musical instruments.—M. Campbell. Preparing peat, small coals, coal tar, petroleum, or other similar substances for fuel.—W. Dean and J. Keighley. Apparatus for raising beer or other liquids.—J. J. F. Stevens. Compensating for expansion and

(CONTINUED ON PAGE 14.)

Scientific and Literary Review,
AND RECORD OF PROGRESS IN
ARTS, INDUSTRY, AND MANUFACTURES,
INCORPORATING THE
JOURNAL OF THE INVENTORS' INSTITUTE.

APRIL 1, 1873.

EDUCATIONAL ENDOWMENTS.

Education has at last become a prime question, alike for politicians, religionists, and anti-religionists. Ignorance is to be driven out of the land, and the "three R.'s," together with more or less of the "graphies" and "ologies," are to be firmly fixed in the brains of every Briton.

Zeal for Public Education does not, however, cease when provision has been made for Elementary Education, it is equally alive in regard to advanced education, so much so that we have just witnessed the resignation of a Ministry, occasioned by its failing to produce such a scheme of reformed University education for Ireland as would prove acceptable, not only to the people of Ireland, but also to the people of England and Scotland—a problem, considering all things, easy to propound but very hard to solve. But the subject of Irish education is not the only vexed question, educationally, that our Government has to face, seeing that our Legislature not very long ago recognized the fact that it was necessary to make arrangements in regard to that branch of advanced education which is sometimes termed secondary, for the progress whereof many of our ancestors felt so much concerned that they bequeathed much property for its practical development, as evidenced to all the world by such glorious institutions as Eton, Winchester, Westminster, Harrow, Christ's Hospital, and many others. To place such schools on a footing accordant with the present times, the Endowed Schools Commission was established, and there is no doubt it has hitherto operated zealously, if not wisely. It has without question succeeded in turning inside out many a time-honoured institution, some of them, if the truth be told, sorely needing reformation. However, like other results of modern thought, the action of this Commission has been restricted to looking sharp after the pence—the small things—and leaving the pounds—the large things—to take care of themselves. Eton, Winchester, Westminster, and other institutions, where our aristocracy and wealthy classes have, with unblushing effrontery, appropriated to themselves the patrimony of the poor, have been either left untouched or dealt with so tenderly as to be still practically in much the same position as in by-gone times. The schemes of amendment have had reference only to such institutions as have more or less been fulfilling the intentions of their founders. Perhaps the most notable instance of the kind of action adopted by the Commission is the case of the Emmanuel Hospital in the City of Westminster; an institution regarding only the school branch of it—for it also embraces provision for needy aged persons by means of almshouses—which has from an ancient date been carried on under the governance of the Lord Mayor and Aldermen of the City of London, no one complaining that the education imparted had not kept pace with the times, or that the children admitted into the schools were sons of affluent persons; nevertheless, the Commission must needs decide upon ousting the Aldermen from their position, and then proceed to lay down rules as to the admission of children into the school which are some of them based on mere idealities and others are vicious in principle.

Amongst others is their plan of affording a semi-charity education to those who can pay for it, copying the abominable system of robbing the poor, which is practised at Eton, Winchester, Harrow, and other large public schools, by applying the revenues of the institution to the enhancement of the educational advantages of those persons who are quite capable of obtaining these advantages for themselves at their own cost. We are not quite sure that the Lord Mayor and Aldermen have quite understood the real question they have to deal with in administering this trust of Emmanuel Hospital School. Lord and Lady Dacre, who founded the school, appear to have laid it down as the base of the institution that the pupils thereof should be trained up in such a way as to be fit to exercise efficiently arts and industry, and this, if it means anything at all as applicable to the wants of the present day, means that the education imported should partake more of the technological than of the literary character. It may also be a question whether there is not a great deal to be said in favour of what the Commission has proposed as to the scholars of the Public Elementary Schools who have passed good examinations, and whose parents are needy, enjoying the benefits of the school, which includes board and maintenance, rather than children selected merely because their parents are poor, for on that, as the sole ground of selection, we cannot see why one poor person's child is to go into the school and another is to remain outside. It may also be desirable that the local authorities in the City of Westminster should have some voice in the nominations to the benefits of the institution, though on this point it ought to be held in remembrance that the Aldermanic body is a part of the guild system which expands beyond the City district; but be all these things as they may, we know enough of the Aldermanic body of London to know that these points would only require to be brought before it to be fully and fairly dealt with. It is by no means necessary to oust the jurisdiction of that body in order to obtain what may be desirable.

Moreover, keeping in view the fact that the founders of the institution evidently intended to provide such an education as should fit its pupils for practising the arts and trades of civilized life, which in these days should partake of the technological rather than the literary character, the Lord Mayor and Aldermen of London, as being men of commerce and trade, would seem to be as proper guardians as could well be selected; and one cannot help thinking this was the view the pious founders entertained in appointing them to that office, as otherwise the Dean and Chapter at Westminster would from their well-acknowledged learning have been likely to be selected.

With regard to Christ's Hospital, or the Blue-coat School as it is sometimes called, there is even a stronger case against the interference of the commission than in that of the Emmanuel Hospital. It is true that King Edward VI. appropriated part of the property of certain suppressed religious institutions to found and endow that school for necessitous children of *Freemen* of *London*, who might possibly require such assistance; but this endowment forms but a small part of the funds of the institution, and independently of other endowments the establishment is supported by sums of money paid by former and present life governors, who are never a small body, and are men of the highest character and position; consequently, not to speak of their money interest in the matter, are far more capable of administering the affairs of the institution than a few bureaucrats who may perchance have been placed in office by political or Court influence.

There is much useful work for the Endowed Schools Commisssion to do in guiding public gratuitous secondary education into a right channel, so that the poor man's child, who shows capacity for higher education, shall have his chance of obtaining such education, even when it is necessary to feed and clothe him in order to do this; but it will fail to accomplish it by inaugurating a new half-pay system in lieu of gratuitous instruction, or by upsetting the constitution of managing bodies that are as good as could possibly be selected.

Reviews.

The Theory of Strains in Girders and Similar Structures, with Observations on the Application of Theory to Practice, and Tables of the Strength and other Properties of Materials. By Bindon B. Stoney, M.A., Member of the Institute of Civil Engineers, and Engineer to the Dublin Port and Docks Board. With numerous illustrations, engraved on wood, by Oldham. New edition, enlarged and revised. London: Longmans, Green, and Co. 1873.

We are glad to find that a new edition of this truly practical, yet thoroughly scientific, work has been called for. Seldom have we to deal with a work so complete as regards the statements of practical details, and so perspicuous in developing the scientific principles involved herein.

The importance of the subject treated of cannot be over-rated, for, as Mr. Stoney aptly remarks:—

"A thorough acquaintance with the theory of strains and the strength and other properties of materials forms the basis of all sound engineering practice, and when this is wanting, even natural constructive talent of a high order is frequently at fault, and the result is either excess and consequent waste of material, or, what is still more disastrous, weakness in parts where strength is essential. The time has gone by when practical sagacity formed the sole qualification for high engineering success. Before the improvement of the steam engine gave rise to a new profession there were, indeed, some memorable names on the roll of engineers, generally self-taught mechanics, whom great natural ability had raised to pre-eminence in their profession; but practice which was formerly excusable, or even worthy of the highest commendation, would, now that knowledge has increased, be properly described as culpable waste, arising either from prejudice or ignorance."

The work now contains explanatory remarks as to strain, tension, compression, transverse strain, shearing strain, and torsion. Perhaps, however, the following statements as to expansion and contraction are the most interesting part of the work:—

Arches, Camber, Suspension Bridges Deflect, and Girders Elongate, from Elevation of Temperature—Expansion Rollers.—Changes of temperature affect bridges very differently according to their mode of construction. An increase of temperature causes the crowns of iron arches which are confined between fixed abutments to rise, and the spandrils to extend lengthways, chiefly along their upper flange or horizontal member; hence, room for longitudinal expansion should be provided by leaving a vertical space between the ends of the spandrils and the masonry of the abutments above springing level. When iron arches extend over several spans, the spandrils of the different spans should not be rigidly connected together like continuous girders, for then their expansion may cause a dangerous crushing strain along the vertical line of junction and throughout the horizontal member, a portion of which strain will, no doubt, be transmitted to the ribs themselves. When, therefore, it is considered desirable to connect together the spandrils of consecutive iron arches, this should be effected by sliding covers, or some similar contrivance, which, though they restrain lateral motion, yet will allow perfect freedom for changes of length. The rise in the crown of one of the cast-iron arches of Southwark Bridge was observed by Mr. Rennie to be about 1·25 for a change of temperature of 50 deg. F.; the length of the chord of the extrados is 246 ft., and its versed sine is 23 ft. 1 in.; accordingly, the length of the arch, which is segmental, is 3020·8 in. The cast-iron bridge of Charenton, whose span and versed sine are 35 and 4 metres respectively, has been observed to rise 14 millimetres (·55 in.) on the side exposed to the west from an elevation of 14 deg. C. in the temperature of the air.

Stone arches are affected in a similar way to iron arches. With increased temperature the crown rises and joints in the parapets open over the crown, while others over the springing close up. The reverse takes place in cold weather; the crown descends, joints over the springing open, and those over the crown close. When stone or iron arches are of large span these movements, from changes of temperature, will generally dislocate to a certain degree the flagging and pavement of the roadway above. This is very conspicuous in Southwark Bridge.

An increase of temperature causes suspension bridges to deflect, just the reverse of what happens with arches. Girders, which exert only a vertical pressure on the points of support, extend longitudinally under the same influence, and on this account it is usual in long bridges to provide expansion rollers, or, if the span be moderate, sliding metallic surfaces, under one end of each main girder. It may be questioned, however, whether sliding surfaces remain long in working order, and some engineers prefer timber wall-plates beneath the ends of the girder, even when the span reaches 150 ft. In place of being supported by rollers, which are apt to set fast, girders are sometimes hung from suspension links, the pendulous motion of the links affording the requisite longitudinal movement due to change of temperature. The chains of suspension bridges are generally attached to saddles which rest on rollers on top of the towers; the object of these, however, is rather to compensate for unequal loading than for changes of temperature.

The working load is a point that has received much attention from Mr. Stoney, as evinced in the following passages:—

Working Strain of Cast-iron Girders—Rule of Board of Trade—Working Strain of Cast-iron Arches—French Rule—Proving Cast-iron.—The reader will observe that the Commissioners considered one sixth of the breaking strain hardly a sufficient limit of safety for cast-iron girders when liable to percussion and deflection from moving loads. This inference was, no doubt, influenced by their experiments on bars which were much lighter in proportion to their trial loads than ordinary bridge girders are compared with the loads which traverse them. As a general rule, *one-sixth* of the breaking strain may be taken as the safe working strain for cast-iron girders which are liable to vibration, as in railway or public bridges, but when the load is stationary and free from all vibration, such as water tanks, *one-fourth* of the breaking strain is safe. When, however, cast-iron girders are liable to sudden severe shocks, as in crane posts or machinery, their working strain should not exceed *one-eighth* of their breaking strain. The railway department of the Board of Trade has laid down the following rule for the guidance of engineers in the construction of railways:—"In a cast-iron bridge the breaking weight of the girders should be not less than three times the permanent load due to the weight of the superstructure, added to six times the greatest moving load that can be brought upon it." Notwithstanding this rule, engineers will do well not to design cast-iron girders for railway bridges of less strength than six times the total maximum load, that is, six times the permanent load added to six times the greatest moving load. The reader who desires detailed information respecting the practice of our most eminent engineers during the reign of cast-iron is referred to the evidence attached to the "Report of the Commissioners appointed to inquire into the application of iron to railway structures" in 1849. It seems certain that the transverse strength of thick rectangular cast-iron bars is less than that of thin ones (132), but it does not necessarily follow that the strength of large flanged girders is diminished by the massiveness of the casting or that they are relatively weaker than smaller girders of similar section, for the quality of the iron will, no doubt, materially influence their strength (348, 349). Experiments on a large scale can only decide these questions, which, however, have less importance now than when the Iron Commission sat in 1849, as it is very unlikely that large cast-iron girders will be employed in important works when wrought-iron is available.

Cast-iron can be readily got, on specification, to stand from 7½ to 9 tons per square inch in tension: consequently, the rule of one-sixth allows an inch-strain of from 1¼ to 1½ tons for the usual safe tensile working-strain in the lower flanges of cast-iron girders, but this material is quite unfitted for tie-bars for the reasons referred to in 350 and 351. Cast-iron will safely bear 6 or 7 tons per square inch in compression, provided it be in a form suited to resist flexure; but the effects of flexure will seriously diminish the safe unit-strain for pillars or unbraced cast-iron arches, in which the line of pressure may vary so as to alter the calculated unit-strain very materially, perhaps as much as 50, or even 100 per cent. In practice, the safe working-strain of cast iron arches rarely exceeds 3 tons per square inch. For instance, the calculated working strain in the Severn Valley Bridge, carrying the Coalbrookdale Railway, 200 ft. span and 20 ft. rise, is between 2½ and 3 tons per square in., while that of the centre arch of Southwark Bridge, 240 ft. span, is about 2 tons per square inch.

The French Ministerial limit of working strain for cast-iron in tension is one kilogramme per square millimetre (= 0·635 tons per square inch), and in compression five kilogrammes per square millimetre (= 3·175 tons per square in.), and the table (given in the work) prepared by M. Poirée, engineer of Ponts et Chaussées, illustrates some of the best French practice in cast-iron arches.

The direct tensile strength of cast-iron may be tested in the manner described in 482, but it is also usual to prove its transverse strength by breaking small rectangular bars made of the same metal, and at the same time, as the principal castings. The following tests were applied in the case of the cast-iron sleepers provided for the Great Indian Peninsula Railway:—The mixture of metal is to be such as will produce the strongest and toughest castings, and is to be approved as such by the consulting engineer. The contractor must cast twice each day, from the same metal as that used in the sleepers, two duplicate bars 3′ 6″ × 2″ × 1″, and two duplicate castings of the form shown on the contract drawing, and exactly 1″ square for a length of 1½″ in the middle. One of the two bars must be tested on edge, on bearings 3 ft. apart, by placing weights on the centre thereof, to ascertain its elasticity and breaking weight; and one of the two castings must be tested in a suitable machine of approved construction to ascertain the tensile strength of the iron. The company's inspector will reject all sleepers cast on any day when each of the bars will not bear 30 cwt. placed on the centre without breaking, or when each bar does not reflect at least 0·29 of an inch before fracture, and when each casting will not bear a tensional strain of 11½ tons per square in. of section. Three sleepers will also be tested each day by a weight of 3¾ cwt. falling through 5′ 6″, the same having previously been subjected to blows from the same weight falling through 2′ 0″, 2′ 6″, 3′ 0″, 3′ 6″, 4′ 0″, 4′ 6″, and 5′ 0″ successively after the sand foundation (which shall not be more than 24 in. thick under the centre of the sleeper, and laid on a cast-iron bed plate 8 inches thick, and weighing 2 tons,) has been well consolidated to the satisfaction of the consulting engineer or his inspector; and whenever every sleeper, so tested, does not bear these blows without cracking, or showing other signs of failure, the day's make will be rejected. Immediately after every sleeper is cast, it must be protected in a manner which will satisfy the company's engineer, that the process of cooling will proceed so slowly that its strength will not in any degree be diminished by too rapid or unequal cooling. Some engineers consider this proof rather high, and specify that test bars, 2 × 1 in., placed edgeways on bearings 3 ft. apart, shall support a weight on the centre of 25 cwt., as it appears that sleepers can be obtained which would stand better, as far as blows went, without using so high a bar test as that above described. It is a singular fact that there is an excess of about 16 per cent. in the weight that a 2-in. × 1-in. test bar will support when cast on edge and proved as cast, over that which it will support when proved with the underside as cast placed at the top as proved, and 8 per cent. over the weight which the same test bar will support if cast on its side or end, and proved on edge. Hence, cast-iron girders should be cast with the tension flange downwards in the sand.

474. Working Load on Cast-iron Pillars.—Owing to the want of recorded information it is difficult to assign what proportion of the breaking weight eminent engineers have considered to be the safe working load for cast-iron pillars. The opinions elicited by the Commissioners appointed to inquire into the application of iron to railway structures throw little or no light on the matter, as the evidence was chiefly confined to the strength of girders under transverse strain. Navier gives 1-5th of the breaking weight as the safe load in practice. Francis, an American engineer, also gives 1-5th; while Morin adopts 1-6th. My own experience leads me to recommend that cast-iron pillars supporting loads free from vibration, such as grain, should in general not be loaded with more than 1-6th of their calculated breaking weight. In factories or stores, where strong vibrations from machinery occur, the working load should not exceed 1-8th; and if the pillar be liable to transverse strains, or severe shocks, like those on the ground floors of warehouses where loaded waggons or heavy bales are apt to strike against them, the load should not exceed 1-10th of the breaking weight, or even less when the strength of the pillar depends rather on the transverse strain to which it is liable than the weight it has to support. For instance, the pressure of wind against a light open shed, supported by pillars, may produce a transverse strain which will be very severe compared with that due to the mere weight of the roof. The same thing may occur if heavy rolling goods, such as casks, or loaves of sugar, are piled up against the pillar in such a manner as to cause horizontal pressure like that of a liquid. It is also necessary to take into consideration the foundations on which the pillars rest, for, if these yield unequally, one pillar may sustain much more than its proper share of load. Wrought-iron is gradually superseding cast-iron for struts in machinery; when, however, cast-iron is adopted, it is well that the working load should, at all events, not exceed 1-10th of the calculated breaking load. In all these cases it is essential to consider carefully whether the pillar is flat bedded or very securely fixed at the ends, as a slight imperfection in this respect, either immediate or prospective, will reduce the strength to one-third in long pillars, and somewhat less in medium pillars, and if there is any doubt whatever on this point it will be only common prudence to assume in the calculations that the pillar is imperfectly bedded (311, 312). The reader will find practical rules for the thickness of hollow cast-iron pillars in 324, and examples of calculation from 322 to 329.

475. Effects of Repeated Deflections on Wrought-iron Bars and Plate Girders.—Sir Henry James and Captain Galton made some experiments in Portsmouth Dockyard for determining the effects produced by repeated deflections on wrought-iron bars. These experiments were made with cams caused to revolve by steam machinery, which alternately depressed the bars and allowed them to resume their natural position for a great number of times. Two cams were used; one was toothed on the edge so as to communicate a highly vibratory motion to the bar during the deflection; the other, a step cam, first gently depressed the bar and then released it suddenly when the full deflection had been obtained. The depressions were at the rate of from four to seven per minute.

476. Net Area only Effective for Tension—Allowance for the Weakening Effect of Punching—Rule of Board of Trade for Wrought-iron Railway Bridges Tensile Working Strain of Wrought-iron—French Rule for Railway Bridges.—The reader will recollect that the whole area of a rivetted plate is not available for tension, but only the unpierced portion which lies between the rivet holes in any line of transverse section; this is called the *net* area of the plate, and on this net area alone the working tensile strain should be calculated. The *effective* tensile area of a punched plate is, indeed, somewhat less than its net area, for the tearing strength of iron is generally injured by punching, especially if there be too great a clearance between the punch and die, or if the iron be brittle, and, though it is not the practice, it would be more correct to diminish the gross section by the sum of the rivet holes multiplied by a factor greater than unity, perhaps 1·1, or 1·2. It may, perhaps, be supposed more accurate to add a constant quantity, say 1-8th inch, to the diameter of each hole in place of adding a percentage, but it is probable that the weakening effect of punching is greater the thicker the plate, and as thick plates have generally larger rivet holes than thin ones, the percentage allowance will be more accurate in practice. Good experiments on this subject are much wanted. Meantime, the weakening effect of punching affords an argument in favour of drilling holes, especially in hard and brittle materials. Punching will probably do little injury to soft and ductile iron, or to mild steel, especially when the latter is subsequently annealed (462). The following rule has been laid down by the Board of Trade for the strength of railway bridges:—"In a wrought-iron bridge the greatest load which can be brought upon it, added to the weight of the superstructure, should not produce a greater strain on any part of the material than 5 tons per square inch." This rule is now confined to parts in tension, in which case the 5 tons is computed on the *net* area only, while the usual limit of strain in the compression flanges is 4 tons per square inch of *gross* area, and, as the tearing and crushing strengths of ordinary plate iron are, respectively, 20 and 16 tons per square inch, the foregoing rules are equivalent to stating that 1-4th of the breaking strain is the maximum safe working strain for wrought-iron girders which are subject to vibration like railway bridges, and this is now the recognised English practice. When wrought-iron girders support a dead load, like water tanks or grain lofts, they will safely bear one-third of their breaking strain, but when liable to sudden severe shocks, as in gantries or cranes, the working strain should not exceed one-sixth of the computed breaking strain.

The safe tensile working strain for ordinary bar, angle, or tee iron in girder-work, is generally the same as for plates, namely, 5 tons per square inch of net section, but, bar iron of extra quality, such as the links of suspension bridges, will safely bear 6 tons per square inch. Special care is taken with the manufacture of this class of iron, and it is customary to prove each link individually to a strain of from 8 to 10 tons per square inch before it is admitted into the supension chain, the tearing strength of the iron being not less than 24 tons per square inch. For merely temporary purposes wrought-iron will bear safely a tensile strain of 9 tons per square inch, unless when subject to violent shocks, in which case 6 tons will be sufficient.

The French rule for wrought-iron railway bridges is that in no part shall the strain, either of tension or compression, exceed 6 kilogrammes per square millimetre, *i.e.*, 3·81 tons per square inch of gross section.

477. Gross Area Available for Compression—Compressive Working Strain of Wrought-iron—Flanges of Wrought-iron Girders are Generally of Equal Area.—The total sectional area of a riveted plate is available for compression (flexure being duly provided against), since the thrust is transmitted through the rivet just as if it were a portion of the solid plate, for, if the rivet head be properly hammered up, its shank will upset and fill the hole completely. Even supposing that the rivet do not perfectly fill the hole, an exceedingly small motion of the parts, which must take place before crushing commences, will cause the strain to pass through the shank. In practice, however, the longitudinal contraction of each rivet in cooling will produce an amount of friction between the surfaces riveted together which is generally sufficient to resist any movement so long as the strain lies within the usual working limits (466). The crushing strength of wrought-iron is generally taken at 16 tons per square inch (297), and the safe limit of compressive working strain in girder-work is, according to ordinary English practice, 4 tons per square inch over the gross area, provided the section is so large that it can without extra material be put into a form suitable for resisting flexure or buckling. This is generally the case with the compression flanges of girders. When, however, a thin sheet, like the web of a plate girder, sustains compression, or when the theoretic section of a strut is small, as in the compression bars of a braced web, it is necessary to add additional material to prevent flexure or buckling. Angle, tee, or channel iron are suitable for plate stiffeners or for short struts; for long struts the plan of internal cross-bracing, represented in Plate IV., may be advantageously adopted, the cross-bracing, of course, not being measured as effective area to resist crushing, since it merely keeps the sides in line, but sustains none of the longitudinal thrust, and in small scantlings it will be prudent to limit the maximum compressive working strain to 3 tons per square inch. The working strain of wrought-iron pillars, when subject to shocks, like the jib of a crane, should not exceed 1-6th of the computed breaking weight; with quiescent loads 1-4th is a safe rule. The reader is referred to 330, and the following articles, for the mode of calculating the strength of wrought-iron pillars of various sections.

When wrought-iron arches have braced spandrils, the ribs are free from transverse strain, and will safely bear as high longitudinal strains as the flanges of girders, but if the spandrils are not braced, the line of pressure in the ribs may vary under the influence of passing loads, and thus double, or even treble, the normal working strain (219). The extreme compressive strains, produced by the most unfavourable combination of circumstances in the wrought-iron arched ribs of the Victoria Railway Bridge, in four spans of 175 ft. each, which was designed by Mr. John Fowler, are said in no case to exceed 4½ tons per square inch.

The flanges of wrought-iron girders are generally made of equal, or nearly equal, area, for the deduction for rivet holes in the tension flange is compensated by the higher unit-strain in the net area between the holes which is effective for tensile strain.

478. SHEARING WORKING STRAIN—PRESSURE ON BEARING SURFACES—KNIFE EDGES.—The shearing strength of wrought-iron is substantially the same as its tensile strength (394), from which it follows that the shearing working strain of iron rivets or bolts in ordinary girder-work may equal 5 tons per square inch of section, but, as already stated in 462, the rivet area of a tension joint is usually about 10 per cent. in excess of what this rule allows, in order to compensate for accidental inequalities in the distribution of strain among the rivets. When calculating the area of a plate web from the total shearing strain in the manner described in 54, it is a safe rule to adopt 4 tons per sectional inch of web as the maximum shearing unit-strain, but this rule gives no idea of the amount of material requisite for stiffening the web, and which can only be determined by experience in each separate case (430). The bearing surface of a round bar, such as the pin or bolt of a flat link, is measured by the product of its diameter by the length of bearing, and it appears from the experiments referred to in 461, that the statical working pressure on a bearing surface of wrought-iron may equal 1·5 times the safe tensile strain, that is, it may equal 7·5 tons per square inch of bearing surface. The pressure of rivets in double-shear against the middle plate, supposing friction does not affect the bearing pressure (466), is often double of this, and the pressure of the links of a chain against each other must also be far greater. The rule of the Board of Trade for the steel knife edges of public chain-testing machines requires that the pressure shall not exceed 5 tons per linear inch of knife edge. In my own practice I have frequently put a pressure of 10 tons on each linear inch, and occasionally 17 tons, and found no bad effects.

Strength of Materials and Structures.—Part I.—The strength of materials as depending on their Quality, and as ascertained by Testing Apparatus. Part II.—The Strength of Structures as depending on the Form and Arrangement of their parts, and on the Materials of which they are Constructed. By JOHN ANDERSON, C.E., LL.D., F.R.S.E., Superintendent of Machinery to the War Department, &c. ("Text-Books of Science" series.) London: Longmans, Green, and Co. 1872.

The reputation of the author of this treatise stands so high, whether as a scientific or as a practical man, that it seems scarcely necessary to say that the present treatise is a most valuable addition to the literature of practical science. Its character, and contents are very truly described in the author's prefatory remarks, as being divided into two distinct parts.

The First Part treats of the natural properties of various materials employed in construction, more especially in regard to their strength and elasticity, and their adaptation for particular practical purposes in the arts. The object of this portion of the work is to describe the qualities and characteristics of materials, so far as they are of importance to the engineer, or are exhibited in the results of experiments made with the testing machine.

As it cannot be expected that all will have the opportunity of making experiments for themselves, the first three chapters are devoted to the testing of materials, and to the practical manipulation of a testing machine. In these chapters reference is made to the physical properties of some common materials, by which the student will be able to comprehend the nature of such experimental investigations, and the labour and care needed in order to arrive at true results; and it is hoped that he will be able to comprehend the nature of such experimental investigations, and the labour and care needed in order to arrive at true results; and it is hoped that he will find the subject treated in such a clear and simple manner, that he may understand it without much difficulty.

The fourth, fifth, sixth, seventh, and eighth chapters refer more especially to cast iron, wrought iron, steel copper, alloys, and timber, and are intended to describe their qualities and leading peculiarities.

The ninth, tenth, and eleventh chapters treat, more generally, of the resistance of materials to torsion, shearing, and punching, and to transverse strains, conjoined with impact and vibration.

The first eleven chapters, therefore, have regard to the nature of materials, and the remaining six chapters—which constitute the second part of the volume—are devoted to the strength of structures, when made of the materials previously treated of.

In the Second Part, the student will learn the correct forms which must be given to the various structures in order to obtain the requisite strength, and likewise the best arrangement of materials, as depending on their respective properties, so that by the practical application of correct principles, the maximum of strength may be attained with the minimum of weight and cost.

The experiments most frequently referred to, and which are quoted as "Woolwich experiments," have all been made in the Royal Arsenal for various purposes during the past eighteen years, and chiefly with the American testing machine, which is described in the third chapter, the only exception being certain experiments, to ascertain the strength of ropes under various conditions, which were carried out with a hydraulic testing machine, recently transferred from Her Majesty's Dockyard to the Royal Arsenal.

The author states that, although he has taken pains to ensure accuracy; still, when so many figures have been necessarily transcribed several times, more particularly in the tables, some errors may probably exist. In this part of the work Mr. Charles Topple and Mr. George Cuthbert have both rendered valuable assistance; the former, more especially, in regard to the chapters on structures, where calculations were concerned. Most of the examples given are taken from actual works, which have passed through the author's hands during the past few years.

The sources from whence the results of other experiments have been drawn, or from which extracts have been made, are generally quoted. Reference has very frequently been made to the Blue Book, containing the report of the Commissioners appointed to inquire into the Application of Iron to Railway Structures.

Perhaps as useful and interesting portion of the work as any is that referring to steel.

"Steels differ from each other in many respects, but more especially in regard to the degree of steeliness, and, within certain limits, any degree of steeliness may be obtained. In making fine steel by the cementation or common process, bars of pure wrought iron are enclosed in a fire-clay box, and surrounded with powdered charcoal. The whole mass is then kept at a red heat for a certain period; the porous molecular structure of the iron is opened, and the carbon vapour finds its way into the body of the iron. The bars of iron are subjected to this process for a period generally ranging from five days to a fortnight, or even longer, according to the quality required; the longer the process is continued, the more steely does the bar become.

As some of the bars have a greater opportunity of absorbing carbon than others, and from other contingencies, the steeliness of the batch varies, and uniform quality can only be obtained by breaking the bars into small pieces, sorting these fragments into lots, judging by the appearance of the fracture, and then melting the lots in a crucible. The liquid steel is cast into an ingot, and hammered or rolled into the cast steel of commerce. In casting very large masses, a great number of crucibles are necessary, and as these must all be ready for pouring at the same time, and must be emptied into the mould consecutively, the successful casting of heavy ingots requires a very good organization.

"In the arts, cast steel is required of all degrees of steeliness. The milder sorts of steel are only a little more steely than the harder varieties of wrought iron, and the mildest quality may contain about ¼ per cent. by weight of carbon. The highest qualities contain as much as 1 per cent. of carbon, and there are many intermediate qualities. As compared with hard wrought iron, mild steel, while not containing much more carbon, is yet more perfectly homogeneous in its granular structure, and is superior to it both in strength and in almost every other good quality.

"A good serviceable quality of steel, for many purposes, is now extensively made by the 'Bessemer' process, which appears to be, at first sight, a reverse method to the cementation system described above. The Bessemer process commences with cast iron in the crude state, which is melted and poured into a vessel, and, while liquid, a strong current of air is passed through it. The carbon in the iron is burned out, by the oxygen contained in the air passing through the molten mass, and the other impurities are gradually eliminated, until at length the iron is in condition of comparative purity, and chemically similar to wrought iron. In order to make it into steel, there is added to this purified metal a measured portion of a pure cast iron, generally that called '*spiegeleisen*,' or 'looking-glass iron,' containing a large and definite quantity of carbon, which converts the pure iron into a steel sufficiently good for an immense variety of applications. From the circumstance that steel may be produced by this process at a less cost than by the former method, it is, to a large extent, taking the place of wrought iron.

"Steel, like wrought iron, is much improved in its nature by being thoroughly worked either under the hammer or by rolling. Like most metals, steel is found to be more or less porous after casting, which is due to small air or gas bubbles which have not been able to find their way to the surface; the effect of hammering or rolling is to consolidate the mass, and to render the grains of the metal finer, denser, and stronger.

"During the last few years, Sir Joseph Whitworth has been engaged upon a course of most valuable although most expensive experiments, conducted with powerful apparatus. These experiments have for their object the attainment of steel of great density and general goodness, by combining the best materials and the most thorough working, and using every care that the best skill can devise. In Sir Joseph Whitworth's system, after the liquid steel is poured into a metal mould of sufficient strength, a piston or plug is inserted, upon the top of which there is at once brought to bear the full force of 8,000 tons of hydraulic pressure. The effect is at once perceptible, a corresponding pressure pervades the liquid steel, the porosity is overcome, and the metal shrinks rapidly by the sudden closing up of its pores. The shrinking continues for some time at a rate perceptible to the eye, and afterwards more slowly, for a period of nearly a quarter of an hour. Some of the shrinkage observed is due to the decrease of temperature, but it is mainly owing to the hydraulic pressure.

"In considering the effect of pressure, as compared with a blow, in the consolidation of a mass of steel or iron, it would appear that the former should be the most effective, because the metal acted upon has not an opportunity of lateral yielding, whereas in either hammering or rolling, the metal flows away from the point of impact of the hammer, or squeeze of the rolls. Such is the view taken by Sir J. Whitworth. Hence when the ingot, which has been compressed in the liquid state, is taken out of the mould, it is brought to a working temperature, and is then subjected to a series of squeezing operations by hydraulic pressure, squeeze after squeeze being applied until the required dimensions are arrived at; this hydraulic pressure does not act without control; a dial and pointer shows the amount of compression of the mass, and so prevents any risk of over squeezing and making the article too small. The whole process is carried out with such ease, and is so gentle in its action upon the tools that are employed, that, on seeing the process performed, it is impossible not to feel that it is a great step in the right direction, and it is encouraging to find a man with the courage to go into such gigantic enterprises, for the purpose of advancing practical science.

"The goodness of steel may be said to depend on three things: first, the materials selected; second, the nature of the working to which it is subjected; and, third, the care taken by the makers. These three conditions apply to all descriptions of steel, from mild to high, and each quality is equally good for its own special applications.

"The quality of fine cast steel suitable for cutting tools, contains a larger percentage of carbon than either the milder varieties of cast steel, or the varieties of Bessemer steel, which are taking the place of wrought iron, or even the fine cast steel that is used for the lining of guns. The gun steel contains about ·03 per cent. of carbon, and in its natural state has an ultimate tenacity of from 30 to 35 tons, but when made red hot and cooled in oil, its ultimate strength rises to 40 or 45 tons per square inch. The apparent elastic limit of short specimens rises in an equally remarkable degree, being for untempered steel specimens 10 to 15 tons, and for steel tempered in oil, 28 to 32 tons per square inch. The toughness is also increased, so that the tempered steel may be bent, twisted, or drawn out to a degree, far beyond that to which it would submit in the untempered condition.

"It will thus be seen that the limit of elasticity of mild cast steel, when tempered in oil, is fully equal to three times that of wrought iron. This is an important consideration, which will in time determine the extensive use of that material, and more especially, because it stretches so much before final rupture takes place, which is a very valuable and important property.

"The marked increase in the tenacity of cast or Bessemer steel, as compared with wrought iron, has already led to the application of the latter for many purposes where iron was formerly used, and wherever strength requires to be combined with lightness. In the case of rough structures, such as girders or bridges, the use of steel will gradually advance, the chief difficulty in the way of its more general application being, not so much the difference of cost, as the fact that the engineer is unable to determine whether good steel has been really employed by the contractor; testing would settle the point, but the trouble and expense of testing every bar or plate is a serious practical barrier to the adoption of this plan. It has been suggested that the specific gravity of a cutting from each part of a structure might be taken, steel being 0·1 per cent. heavier than wrought iron, but the difference is so small that the distinction of the quality by that test is rather too delicate for practical purposes. It has also been proposed to take some of the punchings from the plates, to draw them out to a small bar at a smith's forge, and to test them either for tenacity, or by tempering with fire and water in the usual manner. All such testing, however, is not in accordance with the usual practical notions of the workshop at the present stage of our progress.

"In a wide range of experiments made with ordinary cast steel, when in its natural or untempered state, the ultimate tenacity was found to vary from 114,000 lbs. down to 67,000 lbs., the highest being a little over 50 tons, and the lowest a little under 30 tons per square inch; but specimens of steel are often met with both of greater and of less strength than the foregoing. A cast-steel specimen of extreme softness, cut from a Krupp gun, gave an ultimate tenacity of 72,000 lbs., which is very remarkable when the extreme softness of the specimen is borne in mind.

"It might be inferred that the strongest quality of steel was always the best, but it is not so, the amount of tenacity which is desirable depends altogether upon the purpose for which it is to be used, the weaker and softer, or less steely qualities, being more tough, are preferred for many purposes, more especially for structures exposed to vibration.

"The effect of tempering upon steel is to increase its strength, and when the chill is rapid to render it harder and more brittle. In tempering ordinary articles they are first heated to redness and then cooled in water, and thereby made over strong and over hard, and unfortunately very brittle; these defects are then subdued by the application of a gentle heat, which is continued or increased until the required degree of temper is attained.

"The strength is determined by two things: first, the steeliness of the steel, that is, the proportion of carbon which it contains; and second, the rate of cooling. The highest degree of strength is obtained by selecting a high steel, heating it to a dull red, and then chilling it rapidly. These two conditions give a degree of strength combined with toughness, far beyond that which is obtained by giving a higher degree of heat, then chilling it suddenly, and afterwards reducing the temper."

We could quote other portions of the work with confidence in being able to secure the attention of our readers, but the limits of our space will not permit us to do so.

Elementary Chemistry. By F. S. Barff, M.A., Christ's College, Cambridge, Professor of Chemistry at the Royal Academy of Arts, and late Assistant Professor of Chemistry, University College, London, with illustrations. Cassell, Petter, and Galpin, London, Paris, and New York.

As might be expected, from the high reputation of its author, this is a valuable treatise and though of elementary character, demands from us definitive exposition of its character and contents. Mr. Barff states that the book, as far as it goes, professes to enable the attentive student to acquire a sound knowledge of the various elementary facts concerning the most important of the "non-metallic elements," as they are called. It is written for young boys of ordinary abilities, who understand arithmetic as far as proportion or rule of three. The writer's object is to ensure such a sound grounding in chemical science, that the knowledge acquired will enable the student to go on a step further, and easily understand symbolical notation and the more difficult facts concerning the bodies which he has studied; or, should any boy who has learnt what is taught in this book go on further, that he may still have a useful though but a limited knowledge of chemistry. A further, and as he believes a still more important object, the writer has had in view, namely, the mental training of young boys, who will, he hopes, by the system he has adopted, have their reasoning faculties strengthened, and their powers of observation rendered accurate and acute. From some experience in teaching boys, the writer believes that at first they should not be compelled to commit names and quantities to memory, but should be required to observe the experimental illustrations carefully, and that they should be required to explain the experiments and apparatus, even though they cannot recollect the names or proportions of the substances employed. They should, however, have their properties impressed on their minds. By this is meant that they should know, for example, that in making hydrogen a metal is used, and an acid, or some liquid which contains hydrogen, and that the hydrogen comes from it, not from the metal or from the water, and that the water is used to dissolve the solid formed when the hydrogen has gone away, or when potassium or sodium are made to act on water. If they forget the names of the metals at first, no matter; they should, however, be made to recollect that they are soft, lighter than metals generally are, that when exposed to air their metallic lustre is soon dimmed by a white film, and what follows when they are thrown into water. A number of questions for calculation are given in Chapter XVI.; if these are worked out, pupils will soon, it is said, learn without effort the proportionate numbers in which the substances treated of combine, and by constant reference to the chapters where these are treated of, which will be necessary in order to work the questions out, they will soon get accustomed to the names, and will recollect them without effort. In order to ensure the use of language which could be understood by boys, the writer dictated most of the chapters to one of his pupils at the middle school, who took them down in shorthand from his dictation; the boy who did this was a thoughtful boy of about thirteen years old, and any phrase used which he could not understand, was so changed as to make it intelligible to him. By adopting this course the writer hopes that he has adapted his instructions to the capacities of the general run of boys. Chapter XV. is devoted to an explanation of the illustrations, with instructions how to set up apparatus.

These statements afford a fair *exposé* of the character and contents of the work.

Elementary Lessons in Applied Mechanics (Cassell's Technical Manuals.) By Robert Stawell Ball, LL.D., Professor of Applied Mechanics and Mechanism in the Royal College of Science, Dublin, Author of "Experimental Mechanics," with 140 questions for examination. Cassell, Petter, & Galpin, London, Paris, and New York.

It would be impossible to speak too highly of this little book. As a strictly educational work, it is well worthy of hearty commendation, but we hold it to be something beyond this—a useful handy book of reference, as regards the typical forms, and constructions of most of the important implements and machinery adopted, with brief dissertations on the scientific principles involved in their construction and use.

The following explanation of the nature and construction of a class of hydraulic mechanism (the hydraulic ram) not, in general, so well understood as it should be, is worthy of attention.

In this explanation, however, the author refers, as he usually does, to an illustrative diagram, which we are compelled to dispense with, and in consequence, to somewhat alter the wording of the passage. A tube, closed at one end, is provided, along which water flows in the direction of the closed end. This tube receives the water from a stream, and the object of the machine is to send a portion of the water up to a higher level. The tube has a valve near the closed end, which valve is capable of being nicely adjusted; its weight is such that the ordinary pressure of the water beneath is not sufficient to keep it closed; thus the valve falls open and the water flows out. The velocity with which the water flows is gradually accelerated while the valve open, and the pressure consequently increases. When the pressure of the water attains a certain value the valve is pressed upwards and closed. The water which was flowing along the tube is thus suddenly checked. We have already learned that a body in motion exerts a large force when its motion is checked. Water is no exception to this rule. The mass of water suddenly exerts a large pressure and forces open a valve leading to an air chamber in which the air is compressed; a pipe leads from this air chamber and carries up the water to the height required. The pressure in the air chamber depends upon the height to which this latter pipe is carried, but whatever be the pressure the valve will be forced open by the water, a small quantity of which will be driven into the air chamber. When the water has come to rest this valve shuts. The same operation is now repeated; the other valve nearer the closed end drops open in consequence of the pressure not being sufficient, and the cycle again commences. Thus at each operation a small quantity of water is forced into the air chamber, and ultimately must ascend by the before-mentioned pipe leading up therefrom.

The inertia of water which is so ingeniously applied to the hydraulic ram, has to be attended to in the fittings which are used in towns supplied with high pressure of water. Ordinary stop cocks cannot be used in pipes in which the pressure amounts to over 80lbs, upon the square inch. If the water be turned off suddenly, as it is by an ordinary cock, a rattling noise is heard, and a violent strain is produced upon the pipes and fittings which will sooner or later lead to rupture. The remedy is obvious. The force which a body exerts when its motion is arrested varies according to the manner in which the motion is stopped. If the motion be stopped gradually the force is very small; if suddenly, prodigious. The plan is then to cut off the water gradually. This is done by using a cock in which by means of a screw the aperture is closed or opened gradually. The author then proceeds to describe in detail the mechanical arrangements adopted for the above object; but it would be idle for us here to follow him without the aid of the illustrative diagram he refers to; so we must leave such of our readers as desire fuller information on this matter to resort to the work itself.

The substance of this volume, which has been already published in "Cassell's Technical Educator," is divided into Parts and Lessons. In Part I. the mechanical powers are explained and illustrated: Lesson 1 referring to the lever; Lesson 2 to the screw; Lesson 3 to the pulley; Lesson 4 to the pulley-block; Lesson 5 to the crane; Lesson 6 to the hydraulic press. Part II. refers to tools, and Lessons 8 to 12 have for subjects the hammer, the turning-lathe and the slide-rest, the planing machine, the drilling machine, the steam-hammer, the shearing machine and the punching machine. Part III. deals with special applications comprised by Lessons 13 to 18 the girder, machines for raising water (from which we have taken the explanation as to the hydraulic ram), machinery used in sawing timber, the flour-mill, machinery used in the manufacture of sugar, machinery used in the spinning of cotton; and the work concludes with 140 questions for examination.

Steam in the Engine: Its Heat and its Work. By P. Kauffer, Managing Engineer, Leeds. London: Blackie and Sons, Paternoster-buildings, E.C.; Glasgow and Edinburgh. 1873.

We commend this small book on a very interesting subject to the favourable consideration of our readers. It professes to embody the author's practical experience, viewed by the light of data, derived from the experiments of Joule and Regnault. We have no time to say more at present, but hope to revert to this work at an early opportunity.

General Literature.

Some Talk About Animals and Their Masters. By the author of "Friends in Council." Strahan and Co.

The excellence of Sir Arthur Helps' books has been universally acknowledged. There is a quiet beauty in the style, and sometimes a vigorous, but measured force in the thought which please and elevate. They are particularly suited to those who possess leisure to go carefully over their contents, and whose minds have been sufficiently cultivated to appreciate the wide range of thought and reading, by means of which he multiplies his arguments and illustrations. Sir Arthur's books cannot be favourites with those whose lives are given to daily toil, or whose time is occupied with the business struggles of the world. They should be read in well-appointed libraries, or in drawing-rooms that look out on smooth lawns bordered by flowering shrubs, with the green heads of old trees nodding to each other in the distance. Very handsomely bound, they would look charming on Millenial book-shelves, for there, with nothing to do, the calm, happy-minded inhabitants could discuss with no more of a shudder than gave a richer zest to their golden moments, the old barbarities of the world—such as the bearing-rein of the draft-horse, the unkind words spoken to cat or dog, or the cruelties inflicted on geese in transit by close packing. As matters stand in this tough old working world, where men thrash their wives and costermongers belabour their donkeys, and a million paupers are always dying by inches on public charities, and men ruthlessly slaughter each other by hundreds and thousands in Franco-Prussian wars, there is not much time outside of well-appointed drawing-rooms to sympathise with dogs or cats, unless such as are made subjects of vivisection; or with geese, except such as are fed to death before a slow fire, that their enlarged livers may be suitable to make delicious *paté fois gras* for the tables of high-born people, who have little else to do beyond coddling their appetites and nursing their sympathies.

Admitting all this, however, there is still much to be said in favour of Sir Arthur Helps' volume. Its quiet and graceful conversations, without any excitement of feeling, or any exaggeration of language, ramble over a great variety of subjects, and not one of these is left without some fact being brought to light, or some observation being made, in which the reader will find both pleasure and improvement.

It is not all about animals and their ways in reference to men, and the treatment they receive from men. Where, for instance, could a better definition of scandal be found than this, given by a little girl at a school examination:—"Nobody does nothing, and everybody goes on telling of it everywhere." Or where could we put our hand on a better bit of covert truth than the following:—'Everything seems clever and uncommonplace in a language of which you know but little; and that is why we appear such clever and interesting fellows to dogs. If they knew our language well, would any dog sit out a public dinner." The rules laid down at pages 36 and 37 for writing on matters connected with real life are excellent, and if followed would certainly ensure precision and clearness. Then, by way of diversity, there is a plea for applying "drags" for the purpose of stopping "'busses," not only for the comfort of the horses, but for the safety of the public. After this we stumble on a curious reference to Bishop Berkley's "Querist," a book which nobody reads now, perhaps, for the reason that it is too old and dry for Mudie's Library, but which is, nevertheless, in much of its contents a curious anticipation of many questions which we, in the fuller development of our beaver faculty, are only beginning to discuss. Present controversies about technical education, had a curious anticipation in the following queries of the good old bishop:—

"Whether France and Flanders could have drawn so much money from England for figured silks, lace, and tapestry, if they had not had academies for designing.

"Whether our linen manufacture would not find the benefit of this institution; and whether there be anything that makes us fall short of the Dutch in damasks, diapers, and printed linen, but our ignorance in design.

"Whether those who might slight this affair as notional, have sufficiently considered the extensive use of the art of design, and its influence in most trades and manufactures, wherein the forms of things are often more regarded than the materials."

There follows this many well-selected passages from old writers on the treatment of animals, which may be read again and again, as few things can be better as an occasional study than such shreds and patches of wisdom when judiciously selected and cleverly-worked into the web of a story or treatise; but we prefer pointing out such new things as may be regarded as original. A wise old father, several of whose younger relatives stood for Parliament, and who were all rejected but one, and he, as it happened, was by many degrees the least qualified of the lot, when asked the reason why the best qualified were rejected and the worst accepted, aptly replied, "Oh, his nonsense suited their nonsense," and how much of human life this answer explains. "You don't win people by talking their sense to them, but by talking their nonsense to them, which they are fondest off. And then if you can talk the right nonsense to the right people at the right time, you must succeed." A valuable short sermon on a pleasant text, which, no doubt, will be amply illustrated at the general election now, we presume, approaching. The right nonsense to the right people in the right place has its completeness and power verified when candidates meet constituents; if not, then the statement cannot be true anywhere on this our globe.

Passing on to something better, we notice the following as a pleasant truth worth making known:—"The reason why great literary men and great statesmen are such interesting companions, is, not only that they have a very wide range of subjects, but that they are generally very anxious to persuade their companions of something, to bringing them round to their way of thinking; and their earnestness is contagious, and creates earnestness and, therefore, pleasure in the soul of the hearer. And, in general, these men are delighted with any companion who is appreciative and receptive, whatever his other gifts or failings may be." The conversation on companionship, with which the book finishes, is very good; but we shall extract no more of it, as it will furnish pleasant reading to whoever has time to turn to it, and go leisurely over its instructive, pleasant, and polished pages. We should prefer it if there was more natural ruggedness and irregularity in it, more of the dash of thought, which creates enthusiasm in the reader. As it stands, however, it is very good, and will please many readers better than if it had more of the quality we ourselves desire to see in it.

(General Literature Continued on p. 13.)

Engraving in Japan.—The Japanese Government propose to have an institution for the study of practical engineering, and have instructed their agents to procure a set of machinery and tools similar in all respects to that which the Crystal Palace Company, last autumn, constructed for the purposes of their admirable school for practical engineering, under the supervision of Professor Wilson, as principal.

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Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES.

Thurseay, April 10th. Meeting to consider the action to be taken by the Inventors' Institute in regard to the forthcoming International Patent Congress in Vienna.

Thursday, April 24th. On "Our Colonial Patent-Law System," with some suggestions for its amendment. By F. W. Campin, barrister-at-law.

Monthly Notices.

A free library in the City of London—A proposition of Mr. Macfie's—Technical Science instruction at Stationers' Hall—Proposed Law for Registration of Trade Marks—Dramatic Copyright—Resignation of the Secretaryship of the Meteorological Society by Mr. J. Glaisher, F.R.S.—Re-appointment of Dr. Carpenter to the Swiney Lectureship--Meta-vanadic Acid—New source of Antimony—Professor Everett on Mirage—Memorial to Professor Sedgwick—Glacial deposits in California—Mr. R. Brough Smyth—Hematite ores in the Furness district—Observatory of Paris—Professor Guthrie on the relation of Heat and Electricity—News from Sir B. Frere's Expedition—Women's rights and the Pharmaceutical Society—Mr. W. Smith's experiments on Silenium—Coal in the Isle of Wight—Improvements in Puddling Iron—Glycerine as a solvent for coal-tar colours—Trade instruction in the Army.

A fact reflecting the highest credit on the City of London ought to receive the widest publicity; it has established, without calling upon the already overburdened ratepayers to pay new rates, a magnificent free library at the Guildhall, King-street, Cheapside—a place worthy of a visit, if only for the sake of its architectural beauties. The names of Dr. Saunders, the Chairman of the City Library Committee, and Mr. Overall, the Librarian, ought to be held in grateful remembrance by all Londoners for the efforts to obtain the above-mentioned result. And this fact may serve to cover a multitude of the sins of the City Common Council.

For once we approve of a suggestion made by Mr. R. A. Macfie, M.P., so well known for his anti-patent law proclivities. In a memorial by him, addressed to the Lord Chancellor, praying that he would take measures to re-arrange our Patent Office system, in accordance with the report of the Select Committee of the House of Commons on letters patent, he suggests that the Board of Patent Office Commissioners should comprise persons enjoying the confidence of "*Inventors*' and Engineers' Institutes." After this we think there is yet some hope for even Mr. Macfie!

We rejoice in being able to inform our readers that Technical Education, in connection with the City Guilds, is making further progress. The present Lord Mayor, Sir S. H. Waterlow, who is also, we understand, the Master for this year of the Worshipful Company of Stationers, has arranged for lectures to be given under the auspices of that company, with reference to paper-making, printing, printing presses, printing machinery, and other subjects connected with the stationery trade. We would venture to suggest that the company should hold examinations on the subjects of the lectures; that prizes be awarded, and that from the highest class of those who passed these examinations, young men should be selected for the presentation of the freedom of the Company gratuitously.

It has been recently announced that a Bill is shortly to be introduced into Parliament, providing for the Registration of Trade Marks,—such a measure has long been recognized as a public necessity for protecting the *bonâ fide* trader, and as tending to protect the public against impostures by vendors of spurious wares.

Much correspondence has lately occupied the columns of the public journals in regard to copyright in dramatic works. The present law, which pays little regard to thoughts, and dwells much upon the form of words, in which they are clothed, is said by some to be insufficient in protective effect. Be this as it may, we warn literary men that they are treading on dangerous ground when they get away from the present system. It is the necessity of restraining *imitation* as well as *copying*, that creates much of the difficulty and expense of patent law suits.

Mr. J. Glaisher, F.R.S., is reported to have resigned the Secretaryship of the Meteorological Society which he has held from its foundation.

The Swiney Lectureship in Geology, which is tenable for five years, has been given to Dr. Carpenter, who was Swiney Lecturer some few years ago.

Meta-vanadic acid was recently the subject of a communication to the Manchester Philosophical Society by Dr. B. W. Gerland, in which he describes the preparation of this substance in the form of scales of a beautiful lustre and deep orange colour. "Vanadium-bronze," or gold-like substance, is said to be perfectly permanent in the air; and Dr. Gerland thinks it will become a favourite bronze, valued even higher than gold.

A new source of antimony of high quality has, it is expected, been discovered in the Italian Alps by Mr. W. P. Jervis, the Director of the Industrial Museum of Turin.

The *Athenæum*, in its Science Gossip, states that the optical principles of the curious atmospheric illusions known as the mirage have lately been studied by Prof. Everett, of Belfast. After investigating some of the laws which govern the formation of images in a medium of continuously-varying index of refraction, and thus establishing the law of ray-curvature, he applies these principles to the explanation of most of the phenomena of mirage, and points out the mistakes which previous writers on this difficult subject have frequently committed.

It is proposed to erect a memorial to the late Prof. Sedgwick, and it is rumoured that this is likely to take the appropriate form of a new Geological Museum at Cambridge.

Among the detrital materials forming the gold-bearing deposits in the deep "placers" of California, silicified trunks of large trees are by no means uncommon. These drift-deposits are probably of later Pliocene age, and are in many cases capped by an outflow of lava or other eruptive matter. The wood, whilst retaining its structure, has in some instances been converted into lignite previously to the silification, and occasionally fragments of the same tree resemble jet in one portion and opal in another. A specimen exhibiting this gradual transition from silicified wood to silicified lignite has been examined by Mr. J. A. Phillips, and his comparative analyses of the two portions are published in the current number of the *Geological Magazine*.

Mr. R. Brough Smyth, the indefatigable Secretary for Mines for the Colony of Victoria, has constructed a sketch of a new geological map of Victoria, founded on Geological Surveys made under the direction of Mr. A. R. C. Selwyn and his officers, and on surveys made by the Mining Department. This map, for its clearness and completeness, merits much commendation.

The deposition of certain hæmatite iron-ores in the Furness district, according to Mr. W. Brockbank, must be referred to glacial action. These valuable ores occur partly in veins and pockets in the carboniferous limestone, and partly in the form of superficial deposits, filling hollows in the limestone, and covered only by post-tertiary gravels and clay. Mr. Brockbank believes that the ore in these superficial deposits has been transported from its original place of occurrence by the agency of ice, and re-deposited as drift wherever there was a cavity convenient for its reception.

The reorganization of the Observatory of Paris has been completed and confirmed by a decree of the President of the French Republic. M. Le Verrier has been appointed Director, with MM. Belgrand, Fizeau, Janssen, Tresca, Daubree, Y. von Villarceau, Wolf, and Gaillot Roy, for the Council. M. Marie Davy is appointed Director of Meteorological Observatory of Montsouris, Paris, and Dr. Stéphan, Director of the Observatory of Marseilles.

Les Mondes contains an important paper on the observations by which M. Janssen discovered the true nature of the Solar Coronna.

A new relation between heat and electricity has been studied by Prof. Guthrie. It is found that the re-action between an electrified body and a neighbouring neutral body, by which the latent electricity of the latter is decomposed by induction, becomes greatly modified when the temperature of the neutral body is raised. It appears that some of the phenomena observed in these researches admit of explanation by assuming the existence of an electrical coercitive force, and the diminution in the intensity of this force on an elevation of temperature.

It has been reported that Sir Bartle Frere and his suite, and also Lieutenant Cameron and Dr. Dillon, of the East Coast Livingstone Expedition, have arrived at Zanzibar. Lieutenant Cameron had suffered from fever, but was recovering when the mail left. Bagamoyo was to be left for the interior not later than the 18th Feb.; other advices have since been received.

The advocates of women's rights will be interested to learn that at recent meetings of the Pharmaceutical Society the desirability of admitting ladies to the lectures and laboratory of the Society has been mooted; and certain names appearing as "apprentices and students," it was proposed at a Council meeting that they be elected, but after discussion the matter has been deferred.

According to experiments made by Mr. Willoughby Smith, the Electrician to the Telegraphic Construction and Maintenance Company, a bar of Selenium, when placed in the dark, upon having a current of electricity passed through it, and being then subjected to the action of light, the conducting power is largely increased, but diminishes again upon the withdrawal of the light. This result is ascribed to the luminous rays and not to heat.

The discovery of coal at Whitchurch Bay, Isle of Wight, has been announced; but it seems this discovery is the same as that of the beds of lignite described by Mr. Bristow in 1862.

The process of puddling iron is proposed to be shortened, phosphorous eliminated, and better iron obtained by the adoption of a plan which M. Th. Schurer brings under public notice in the *Bayerisches Industrie und Gewerbe Blatt*, that is, by mixing equal parts of the chlorides of calcium and sodium, which should be applied (in the proportion of about three times that of the quantity of phosphorous in the iron) whilst the latter is in the process of puddling.

Glycerine has been proposed as a solvent for coal tar colours, and is said to have been successfully tested in regard to them when applied in the dyeing of cotton, wool, and silk. Costliness, however, is likely to render nugatory this invention.

We learn from the *Times* that the Adjutant-General of the Forces has issued a general order, by direction of the Commander-in-Chief, with the view to the further development of the system of employment of soldiers at trades, and the formation of an efficient pioneer force in each regiment. Pioneers are to be at once selected by Commanding Officers on the following system—One Serjeant (a carpenter by trade if possible); three carpenters; two bricklayers, one able to plaster, and one able to slate; one painter and glazier; two plumbers and gasfitters; one smith, able to shoe horses; one mason, able to cut stone. To be throughly instructed in use of tools and in entrenching. The serjeant is to be sent to the School of Military Engineering.

MISCONCEPTIONS RELATIVE TO MEDICAL ELECTRICITY.

THE practical applications of electricity, resulting from the progress in electrical sciences, extend now over a large area, and every movement occurring in any of its branches is worthy of attention. It is a singular fact that the first useful application of electricity was that of restoring health. Ever since (a century ago) this branch of electrical utility has steadily progressed in spite of the many obstacles, which every new discovery is certain to encounter; it was successfully promoted, first by outsiders, and then by scientific members of the medical profession, by whom electricity, as a curative, will ultimately be generally adopted. The improved means of practically applying this subtle power is an important item in the progress of electro therapeutics, and in the extensive, and ever-growing literature, explaining the various medico-galvanic appliances in use, we find side by side with other scientific apparata Mr. Pulvermacher's various inventions of Voltaic Chain Bands, Batteries, &c., frequently treated upon in terms flattering to the inventor. We must, however, confess that it puzzled us not a little to find inventions which are so honorably connected with science and represented in its literature struggling for existence by advertisements in those columns of the daily Press, which are accessible to all comers irrespective of merit. This raised doubts as to the identity of the articles advertised and those referred to in the scientific Press, but an opportunity having lately been presented to us of experimenting the apparatus, it at once brought home to our senses, physiologically as well as physically, its *bona fide* character and efficiency, thus removing our former misconceptions, and at the same time explaining why these chains have acquired such an honorable status.

By a glance at the construction of these chains, the connoisseur will at once recognize the clever manner in which the inventor has satisfied the scientific conditions for *electro generation* on the one hand, and those for *ease of application* on the other. The charging of these flexible batteries is instantaneous by the capillary attraction of acid (vinegar) effected by the metallic surfaces of zinc and copper placed in juxtaposition, close to, but not touching, each other, thus abolishing the trough and a great portion of the resistance of the exciting liquid in the old batteries. The corrected notion we now have acquired concerning these chain bands apart from the services they undoubtedly render both to scientific and popular medical electricity, is that the invention in its various modifications as to size, number of elements, and nature of exciting medium, has a great field for application in other directions, and, together with the various accessories, and are well calculated for familiarising the novice with this admirable force and the laws which govern it, seeing they may be illustrated by means of experiment at a minute's notice, and at little or no expense. As we have above seen, the success, both scientific and general, is owing to *great simplicity*, coupled with great electrical efficiency; and this has, therefore, induced various other persons to put forward contrivances professedly possessing similar powers and virtues; but these persons, either from ignorance of the scientific cause of the efficiency of Mr. Pulvermacher's appliances, or else dreading the penalties attending the infringment of his patent rights, claim to have found the secret of producing portable electric and magnetic contrivances without the use of an exciting liquid, and without magnets. thus endeavouring to mislead the uninformed. This could, however, be to a great extent averted, if Mr. Pulvermacher would undertake to lecture, and demonstrate by experiment, the scientific principles and practical application of his inventions. Sceptics would then become faithful believers, and mere imitators would cease to compete with him.

We trust these observations will induce persons interested in electricity as a curative to investigate these appliances more closely, and thereby satisfy themselves as to their *bonâ fide* nature and evident importance to scientific and popular medical electricity. The invention of Mr. Pulvermacher has been referred to in the following works:—

Bulletin del'Académie de Medicine, Paris. Vote of thanks to Inventor. Vol. XVI., p. 13.	1857
Dr. T. Pereira, F.R.S., &c. Materia Medica, p. 53, ed. IV.	1854
National Philosophy—Dr. Lardner, p. 304. ...	1868
Local Electrization—Duchenne, p. 39.... ...	1855
Electro Physiology and Electro Therapeutics—D. Garratt, of Boston, p. 117.	1861
Epileptic and Convulsive Affections.—C. B. Radcliffe, M.D., p. 180, ed. III.	1861
Elements of Physics.—Prof. Pointlet, p. 694	1856
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Electricity and Medical Treatment.—Dr. O. Kowalewski, Vol. I, p. 121.	1857
Elements of Therapeutic Physics.—Dr. Heidenreich, p. 248.	1854
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Manual d'Electrothérapie, p. 85, ed. I. Tripier...	1861
Medical Electricity, Tibbits, p. 20	1873
Traité Elementaire de Physique Medle. Wimdt, p. 571	1871
Pathology and Therapeutics, by Mr. Wunderlich, vol. I., p. 113	
Effects of the Electric Bath, Gazette des Hopitaux, Paris	
Popular natural philosophy, Ganot, p. 731, ed. 7	1872
Phenomène de la Nature, Valerins, p. 239, vol. I.	1858
L'Electricité appliqué à la Therapeutique Chirurgicale	1870
L'Electro-therapie dans les Maladies Genital et Urinaire, par le Dr. Deloume	1872
Practice of Medical Electricity. Powell, p. 20	1872
L'Electricité appliqués on traitement des Maladies, par Dr. Desparquets	1862
Medical Surgical Electricity. Drs. Beard and Rockwell, p. 137, ed. I.	1871
Guide pratique du Doreur. Roseleur, p. 88, ed. II	1866
Med. Use of Electricity. Garratt, p. 117, ed. II.	1861
Althans, p. 302 & 303, ed. II.	1870
De l'Electricité de l'Action des eaux Minérales. Scutetten	1864
Compendium, p. 231 & 232, ed. III.	1868
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Electricity, Magnetism, and Acoustics. Lardner & Foster, p. 304...	1868

The Inventors' Institute.

At the meeting on Thursday, the 13th of March, 1873, Dr. R. H. Collyer, F.C.S., in the chair, Mr. R. M. Latham, the secretary, reported that the special committee appointed to consider and report upon the statements and recommendations contained in the report of the Select Committee of the House of Commons on letters patent, had held a number of meetings, and considered many of the points referred to in that report; however, the special committee had not yet drawn up a definite report, but hoped it would be able to do so shortly. He could state that that committee dissented from most of the recommendations put forth by the House of Commons Committee, and he might say that every effort would be made to have the report of the special committee ready for presentation at the next meeting of the institute. Mr. Latham also stated that since the last meeting he had learnt that a Bill was in preparation, embodying most of the recommendations of the House of Commons Committee, and he urged the meeting to deal with it at once, as otherwise it might be placed before the Legislature, and accepted as being tacitly sanctioned by inventors at large. After some remarks from the CHAIRMAN, Mr. CAMPIN, and Mr. C. G. CARTTAR, the following resolution was unanimously agreed to and ordered to be published: "That the secretary be directed to convey to her Majesty's Law Officers the unqualified disapproval of the Inventors' Institute of any legislative action being taken based on the recommendation of the Select Committee of the House of Commons appointed to report on the Patent Laws, and expresses a hope that a more complete inquiry, either by Royal Commission, or otherwise, will be instituted into the whole subject, especially as regards the interests of working men and the poorer class of inventors, whose views and interests on the question of Patent Law reform appear to have been wholly ignored, no evidence thereon having been taken by the said Committee. And it is further resolved that her Majesty's law officers be respectfully solicited to receive a deputation representing the Inventors' Institute, that the grave objections which exist as to the said recommendations may be explained in detail, and the views of inventors on the reforms which are urgently needed may be fully set forth."

At the meeting on the 15th March, 1873, Mr. C. G. Carttar, Member of Council, in the chair, the secretary reported that he had communicated with her Majesty's law officers, as requested by the resolution of the last meeting, and that the Government did not intend to bring in any Bill on the subject during the present session, it was, therefore, agreed that further proceedings on the Patent question should be adjourned till the result of the political crisis, arising upon the resignation of the Gladstone Ministry, should be known.

GEOGRAPHICAL SOCIETY OF IRELAND.

AT the annual general meeting of the Geological Society of Ireland, held in the Museum of Trinity College, the President, Prof. Macalister, M.B., read his address, and the following officers for the incoming year were elected:—President, Prof. E. Hull; Vice-Presidents, Earl of Enniskillen, Col. M. Taylor, Prof. A. Macalister, Rev. H. Lloyd, and Sir R. Griffith; Treasurers, Messrs. W. Andrews and S. Downing; Secretaries, Rev. S. Haughton and Prof. R. H. Traquair; Council, Sir R. Kane, Rev. M. Close, Messrs. A. Gages, B. B. Stoney, W. Frazer, A. Carte, W. H. S. Westropp, C. R. C. Tichborne, F. M. Jennings, J. B. Greene, W. H. Baily, W. Ogilby, R. A. Gray, J. E. Reynolds, and E. Hardman.

Proceedings of Societies.

ROYAL SOCIETY.

FEB. 13.—Rear-Admiral Richards, C.B., V.P., in the chair.—The following papers were read: "On Curvature and Orthogonal Surfaces," by Prof. Cayley; and "On a New Relation between Heat and Electricity," by Prof. Guthrie.

Feb. 20.—Rear-Admiral Richards, V.P., in the chair.—The following papers were read: "On the Anatomy and Histology of the Land Planarians of Ceylon, with some account of their habits and description of two new species, and with notes on the anatomy of some European aquatic species," by Mr. H. N. Moseley; and "On a New Locality of Amblygonite and on Montebrasite, a new hydrated aluminium and lithium phosphate," by M. A. O. Des Cloizeaux.

MATHEMATICAL SOCIETY.

FEB. 13.—Dr. Hirst, President, in the chair. —Prof. R. S. Ball and Dr. J. Hopkinson were elected members, and Prof. Greenhill was proposed for election.—The following papers were read: "On the Higher Singularities of Plane Curves," and "On Systems of Linear Congruences," by Prof. H. J. Smith; and 'On the Application of the Hodograph to the Solution of Problems on Projectiles," by Mr. J. Macleod.—The President, Mr. Roberts, V.P., and Mr. Cotterill took part in discussions on the papers.

STATISTICAL SOCIETY.

FEB. 18.—Dr. Farr, President, in the chair. —The following gentlemen were elected Fellows: Messrs. R. Seyd, L. Emanuel, A. G. Browning, E. M'Dermott, R. G. Underdown, and Sir E. W. Watkins.—Mr. R. H. Inglis Palgrave read a paper "On Banking in the United Kingdom." The paper included a review of the present position of banking in Great Britain and Ireland, Hamburg, Denmark, and Sweden, with an estimate of the amount of inland and foreign bills in circulation in Great Britain and Ireland.

METEOROLOGICAL SOCIETY.

FEB. 19.—Dr. Tripe, President, in the chair. —The following gentlemen were elected Fellows: Mr. J. K. Laughton, Rev. A. Mackennal, and Dr. J. Nicol.—The names of seven candidates for admission into the society were announced.—The following papers were read: "A Description of an Electrical Self-Registering Anemometer and Rain-Gauge," by the Rev. F. W. Stow. The general principle on which the registering apparatus is constructed is that of the Morse telegraph instrument as worked in America. The tape is drawn by a clock at the rate of six inches per hour; as it passes over a grooved brass roller, holes are punched in it by a sharp steel-point, drawn down by an electro-magnet whenever the electric circuit is completed, and drawn back by a spiral spring when the contact is broken. There are two grooves in the roller and two electro-magnets, one of which is worked by the anemometer and the other by the rain-gauge; thus, when both magnets are in operation, two parallel rows of holes are punched in the tape. "On the Madras Cyclone of May 2nd, 1872," by Captain H. Toynbee. After giving extracts from several logs containing data during the time of the hurricane, and observations made at the Madras Observatory, the author thinks it seems fair to conclude that the centre of this cyclone passed to the westward and probably to the northward, between the parallels of 10 deg. and 13 deg. N.; that its route was much interfered with by the high land to the west and south-west of Madras; but that it caused very disturbed weather on the west coast of India. "On the Character of the Storm of the 21st—23rd of August, 1868, over the British Isles," by Capt. T. O. Watson.

CHEMICAL SOCIETY.

FEB. 20.—Dr. Frankland, President, i
chair.—The first paper read was, "So
cation of Nitrous-Oxide," by Mr. T.
The gas having been previously liquefi
compression in a strong iron vessel, c
caused to solidify by the rapid evapor
of the liquid in a current of air. It
what resembles solid carbonic aci
appearance. A paper "On Aurin,
Messrs. R. S. Dale and C. Schorle
was read, giving an account of the au
investigation of the composition and c
cal properties of this dye. "Researc
the Action of the Copper-zinc Coup
Organic bodies. I. On Iodide of the E
by Messrs. J. H. Gladstone and A.
was read by Dr. Gladstone; and th
communication, "On the Determinat
Ammonia in the Atmosphere," was re
the author, Mr. A. H. Smee, jun.
method employed is to collect and ex
the moisture condensed from the atmos
on the external surface of a suitable
vessel filled with ice. The lectur
illustrted by drawings of the mag
crystalline forms which are left on e
rating the liquid.

GEOLOGICAL SOCIETY.

FEB. 21.—*Annual General Meeting.*
Grace the Duke of Argyll, President,
chair.—The secretary read the reports
Council, and of the Library and M
Committee. The general position o
society was described as satisfactory
the number of Fellows was said to
essentially increased.—The President
sented the Wollaston Gold Med
Sir P. de Malpas Grey-Egerton, Bart.
balance of the proceeds of the Wol
Donation Fund to Mr. J. W. Judd
Murchison Medal to Mr. W. Davies,
British Museum; and to Prof. Anste
transmission to Prof. Oswald Heer, of Z
the balance of the Murchison Fund.—
Ansted, having suggested that Sir C.
as a particular friend of Prof. Heer's,
very appropriately speak in his nam
C. Lyell referred briefly to the nat
Prof. Heer's work, and said that he wa
that gentleman would appreciate highl
renewed expression of the interest tak
the Geological Society in his pursuits.
President then read his anniversary ad
in which he discussed the phenome
denudation, referring especially to the
ence of subterranean and other move
of the crust of the earth upon the de
tion of its surface, and disputing the
ness of the denuding effects of glacial a
The address was prefaced by geogra
notices of deceased Fellows, including
Sedgwick, Dr. Kelaart, Mr. A. Smith
N. Beardmore, and Prof. Pictet.—The
for the Council and Officers was taken
the following were elected for the en
year:—President, the Duke of Argyll;
Presidents, Prof. P. M. Duncan, R.
Godwin-Austen, J. Prestwich, and Pr
C. Ramsay; Secretaries, J. Evans a
Forbes; Foreign Secretary, W. W. S
Treasurer, J. G. Jeffreys; Council, P
D. Ansted, the Duke of Argyll, W.
ruthers, Prof. P. M. Duncan, Sir P.
G. Egerton, Bart., R. Etheridge, J.
J. W. Flower, D. Forbes, Capt. D. G
R. A. C. Godwin-Austen, J. W. Hulke,
Jeffreys, Sir C. Lyell, Bart., C. J. M.
J. C. Moore, J. Prestwich, Prof. A. C.
say, R. H. Scott, W. W. Smyth, Pr
Tennant, W. Whitaker, and Rev. T.
shire.

Feb. 26.—Prof. Ramsay, V.P., i
chair.—Messrs. J. H. Johnson, H
Philipps, and W. H. Holloway, were e
Fellows.—The following communic
were read: "On the Jurrassic Rocks o
and Raasay," by Dr. J. Bryce,—and
servations on the more remarkable Bo
of the North-West of England an
Welsh Borders," by Mr. D. Mackintos

GEOGRAPHICAL SOCIETY.

FEB. 25.—Major-General Sir H. C. Rawlinson, K.C.B., in the chair.—The following new Fellows were elected: The Marquis of Blandford, Gryf Jaxa Bykovski, Dr. J. Rambaut, Capt. B. Lovett, Messrs. W. H. Davies, S. G. Glanville, A. Margary, F. Read, and R. Short. The paper read was "Notes on Badakshan and Wakhan," by the President. The author showed first, by aid of a wall-map, the present southern boundary of the Russian empire in this direction, the northern boundary of British India, with Afghanistan to the north-west, and the rugged country of various independent chieftains lying between the utmost northern boundary of Afghanistan and the Russian frontier. The river Oxus here has a general course from east to west, but with a large northern bend in Badakshan. We were indebted for our knowledge of the upper course of the Oxus to our own traveller, Lieut. Wood, I.N., a member of Burnes's mission, who ascended the river nearly to its cource. Next to Wood, our best informants were various native surveyors, trained in the service of the Trigonometrical Survey of India, and despatched on the dangerous mission of examining the country beyond our frontier by Major Montgomerie. The principal of these were Mahomed Amin, Abdul Majid, the Pundit Manphul, Faiz Baksh, Ibrahim Khan, and the Mirza. The only part of the Upper Oxus which none of the travellers had seen was a portion of the great northern bend already mentioned. Sir Henry pointed to a map, on a large scale, on the screen, which showed the present state of our geographical knowledge of the region. He further explained that the whole region was very mountainous and rugged, rising from 800 ft. at Kunduz, to 15,600 ft. at Lake Soükul, a distance of about 300 miles in a straight line. The river for the most part flowed at the bottom of precipitous gorges, along which it was sometimes impossible to travel. It was true that the ruby mines of Wakhan, as well as Roshnan and Shignan, lay north of the river, and so were excluded from Afghan territory by the recent arrangement, but, on the other hand, a portion of Darwaz (a Begship north of the Oxus) lay to the south of the river; so that there was a giving and taking of territory. The small mountainous states north of the Oxus had been always independent; neither the Greek kingdom of Bactria, the Sassanian monarchy, the Afghan, the Turks, nor any modern power, had been able to subdue them; and these states would lie between the northern frontier of Afghanistan and the Russian territory. The true geography of this region had been falsified by one of the most curious cases of literary fabrication yet made known. It had been exposed by the late Lord Strangford, and also by himself in an article in the *Edinburgh Review*, and was due to that learned orientalist, Klaproth, who fabricated, partly from Chinese maps and documents, three manuscript works, copiously illustrated by maps, purporting to give the geography of a large part of Central Asia. He invented a story of modern travel to account for each work, and contrived to sell all three at a high price to the Russian and British Governments. Col. H. Yule had recently thrown fresh light on the same singular imposture, especially that part which related to the Upper Oxus, by showing that one of the squares of a Chinese map used by Klaproth had been inverted, so that the east and west sides were made north and south; this gave the Oxus a north and south direction, and threw Wakhan more than 100 miles to the north, or close to the Russian frontier. The Russians have adhered to this false geography, and hence the mistake of Gen. Kaufmann in declaring that Wakhan (a portion of Afghanistan territory according to the new arrangement) lay near the Russian boundary. In conclusion, Sir Henry touched on the political points of the question. He believed that Russia would never consider it her interest to push her frontier up to the Oxus in this direction, and that the British Government had adopted a wise plan in fixing the course of the Oxus as the limit of Afghan territory on that side.—In the discussion which followed, Lord Lawrence expressed his entire concurrence in the views developed in the paper, and entered into details of our recent relations with the Afghan Government, which went to show that it would thoroughly approve of our action with regard to the northern frontier of their country, and that it was not likely to be aggressive beyond it.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

FEB. 26.—At the Council Meeting, Mr. J. R. Planché in the chair, it was announced that the Congress for the present year would be held at Sheffield, during August or the early part of September next, the Duke of Norfolk, being the President.—At the evening meeting, Mr. G. M. Hills, Treasurer, presided.—Exhibitions were made by Messrs. Roberts, J. W. Baily, Levien, Dr. Kendrick, and others; and amongst the objects was a portion of a Roman bronze eagle, presumed to belong to a standard-bearer, and lately found in Victoria-street, City. Mr. Grover, in illustrating it, read a few notes "On Roman Legionary Eagles," and referred to a similar bronze eagle having been found by the Rev. Mr. Joyce, at Silchester, who, he intimated, was about to read a paper on the subject at the Society of Antiquaries very shortly.—Mr. Syer Cumming, V.P., read a short paper "On Roman Water or Conduit Pipes," and illustrated it by some sections of leaden pipes, undoubtedly Roman, lately found in the city and at Beaulieu Abbey, Hants. The piece of the one found in the city was unusually large, being six inches in diameter, and had been produced at a previous meeting of the Association, by Mr. E. Roberts.—Mr. Blashill read a paper communicated by Mr. J. T. Irvine, "On Roman Temples at Bath," and Mr. Grover made some comments thereon, pointing out, amongst other matters, that there was evidence that coal had been used by the Romans for the purpose of keeping up the perpetual or sacred fires in these temples.—The Treasurer called attention to a fine specimen of the peg tankard, said to have belonged to Sir Francis Drake, of silver, and weighing 30¼ oz. avoirdupoise.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

MARCH 4.—Dr. Birch, F.S.A., in the chair.—The following candidates were duly elected members of the society: Rev. Geo. Attwood, M.A., F.C.P.S.; Rev. J. Cunningham Geikie, D.D., John Hall Gladstone, Esq., Ph.D., F.R.S., F.R.G.S.; Col. Charles Seton Guthrie; Mrs. Hamilton Gray, Rt. Hon. Lord Claud Hamilton, M.P.; John Holmes, Esq., Thos. Karslake, Esq., Charles J. Lacy, Esq., Arthur Dyott Thomson, Esq., Professor Wright, LL.D. (Cambridge).—The following paper was then read: "On the Synchronous History of Assyria and Babylonia, translated from the Cuneiform Inscriptions." By Rev. A. H. Sayce, M.A.—This most ancient historical document, which unfortunately exists in a very fragmentary condition, is a chronological history of the two kingdoms of Assyria and Babylonia from the fifteenth to the seventh centuries B.C.; from the time of Karaindas to that of Shalmanser, with whose invasion of Babylonia the record ends, and whose famous black marble obelisk is now in the British Museum. Mr. Sayce accompanied his translation with numerous historical and philological comments, and promised to translate some further historical tablets on another occasion.—An interesting discussion ensued.

MICROSCOPICAL SOCIETY.

MARCH 5.—C. Brooke, Esq., President, in the chair.—Mr. E. J. Gayer contributed some further notes on the Micro-spectroscope and microscope, in continuation of his paper upon the same subject read at the December meeting of the Society.—A paper, by Dr. Maddox, "On a Minute Plant found in an Incrustation of Carbonate of Lime," was also read to the meeting, and was illustrated by carefully executed drawings, and prepared specimens exhibited under the microscope.—The Secretary stated, with reference to some crystals shown at the previous meeting, obtained from the condensed vapour of coke, that they had been examined by Mr. Bell, and found to consist chiefly of protosulphate of iron.—A new metallic chimney for microscope lamps was introduced by Mr. Wenham, its merits being explained by the Secretary, and discussed by the meeting.—Mr. E. C. Baber was elected a Fellow.

THE INSTITUTION OF CIVIL ENGINEERS.

AT the meeting of this Society on Tuesday, the 4th of March, Mr. Hawksley, President, in the chair, nineteen Candidates were balloted for and declared to be elected, including three Members, viz., Mr. John Bennett, Ex-Eng., P.W.D., Government of India; Mr. George James Hervey Glinn, Ex-Eng., P.W.D., Government of India; and Mr. Robert Harris, Engineer of the Eastern Division of the Gas Light and Coke Company.—Sixteen gentlemen were elected Associates, viz., Mr. John Barker, Westminster; Mr. Thomas Holmes Blakesley, M.A., Stud. Inst. C.E., Gray's Inn-square; Mr. Philip Carpenter, Locomotive Superintendent of the Cantagallo Railway, Brazil; Mr. Samuel Brothers Darwin, Secretary and Manager of the Shrewsbury Gas Works; Mr. Edward Giles, Offices of the Crown Agents for the Colonies; Lieut. Fred. Wm. Joseph, Ex-Eng., P.W.D. Bombay; Mr. William Henry King, Stud. Inst. C.E.; Assistant Engineer, P.W.D, India; Mr. Charles Edward Nicholas, Oude and Rohilkund Railway; Mr. Francis James Odling, Stud. Inst. C.E., Devonshire-street; Mr. Arthur Ricketts, Penge; Mr. Richard Edward Speakman, Nantwich; Mr. Thomas Sullock Stooke, Water Works Engineer to the Corporation of St. Helen's; Mr. George Thompson, Government Engineer and Manager, Asuncion and Villa Rica Railway, Paraguay; Colonel John Salusbury Trevor, R.E., Consulting Engineer for Railways to the Government of Bombay; Mr. John Whittingham, Surveyor to the Audlem District, Cheshire; and Mr. George Henry Wood, Buckingham-street.—It was announced that the Council, acting under the provisions of the Bye-Laws, had transferred Mr. William Francis from the class of Associate to that of Member; and had admitted the following Candidates as Students of the Institution, viz., Messrs. Augustus Marius Heaton, Thomas George Bond, Frank Ferguson, Buckham, Montague Martindale, and Edward Thompson.

ANTHROPOLOGICAL INSTITUTE.

MARCH 4.—Prof. Busk, President, in the chair.—Messrs. R. B. Holt, P. Hardwicke, C. A. Howell, and E. W. Cox, serjeant-at-law, were elected Members.—The following papers were read: "On the Looshais," by Dr. A. Campbell; "Flint Instruments and Pottery from Canada," by Sir D. Gibb; and "The Ventnor Flints," by Mr. H. M. Westropp.—The President described an Australian skeleton which the Institute had lately received from Dr. R. Peel, of Adelaide.—Mr. W. Topley exhibited a series of stone implements which he had taken from the surface soil in several counties of England and in France and Spain.—The President announced that in addition to the Psychological Committee which had been lately appointed, and was now in active work, others had that day been appointed, viz., for Physical Characters of Mankind, for Priscan Archæology, and for Descriptive Ethnography.

GENERAL LITERATURE.

CONTINUED FROM PAGE 8.

Plays and Puritans, and other Historical Essays. By CHARLES KINGSLEY. Macmillan & Co.

THIS volume consists of three essays from the *North British Review*, and though republications of such a kind frequently lack the freshness and interest belonging to their first appearance, this volume of Mr. Kingsley vindicates itself in every page from such a censure. There is such a vigour of style, an originality and freshness of thought, a rich picturesqueness of description, that once the book is taken up it must be read through with pleasure, and certainly not without a strong interest being excited in the characters and scenes described.

It is not easy to agree on all points with the writer; nearly every intelligent reader will demur to some of the opinions expressed; but in Mr. Kingsley's case we like him the better for this, and we respect him the more, because we feel that over and above his ability and enthusiasm, there is a respect for the reader's understanding, and a kindly sympathy with honest doubts and differences which place him and the reader from the first instant *en rapport* with each other.

The first essay, that which gives its title to the volume, treats of the character of the English drama down to the latter part of the Puritan times, and strongly sustains the objections urged by the rigidly pious. It is not hard to make out a case on the side taken by Mr. Kingsley. There can be little doubt that the dramatists, from even prior to Shakespeare, down to the days of the second Charles, are on many grounds exceedingly objectionable, and though many reasons may be alleged to account for this, little can be said that by the present age it could be taken implicitly as a justification. Shakespeare stands alone, not free from stain, if we are to fix the canons of orthodox morality, but so free from intentional offence, so far above the facts of life in his time, that we must claim for him, who, as a dramatist, had to listen to the living world and observe its doings; a frank acquittal even from the purest of our modern censors. In truth, he walked in the neighbourhood of the gods and listened to their "large utterances;" he had also listened to the minute melodies of the tiny fairy people who danced their "light fantastic rounds" on the young grass in the pale Athenian moonlight. His eye and ear were divinely touched, and his words, thoughts, and fancies to us are beyond all criticism. We wonder at them and love them, and no mere human reproach can destroy, or even lessen, that wonder and love.

On the other hand, anybody, who will, may say their say about Beaumont and Fletcher, Jonson, Webster, Massinger, Marston, Middleton, Ford, or any other of the great writers who so swarmed in that glorious age that we have in the multitude of their wonderful productions forgotten as much as would have made the literary reputation of any other nation. It is true many of these were coarse and offensive to modern taste, but it should not be forgotten that these men were not "divine," like their great contemporary. They wrote *of* living men and women *for* living men and women; they dealt with the world's vices and the wicked thoughts of men and women in a rather too open and straightforward manner; but nevertheless redeemed by wonderful beauty of thought and language, often elevated by a vigorous and refined imagination. Nevertheless, they were so degraded by a tampering with passions and vices in a vulgar and worldly way, that they offered a sufficiently wide mark for the shafts of the reformers of the day which as frequently were shot by the bigot and hypocrite as by the honest man anxious to preserve the morals of the public from the corruptions of the stage.

And this was so in all things—seriousness and honesty are nearly always attended by sourness and pretence. In religion it was not sufficient—as Lucy Hutchinson informs us in the life of her husband—that we should conform in doctrine, and in the fashion of comparatively short hair, but he was accused openly of want of true piety, because he objected to cutting his locks to a Vandyke pattern, which was one of the extreme follies of enthusiastic reforming Puritans. Still it must be admitted that the Puritans have been grossly mirepresented. Butler, Lestrange, and others have marked them with ridicule, and brought upon their memories an undeserved contempt, from which Mr. Kingsley labours very zealously and very effectually to free them. No doubt the portrait he had sketched, with a few necessary harsh but requisite touches left out, is as correct as it is vivid and life-like. What can be better than the following:—

"Was there no poetry in these Puritans, because they wrote no poetry? We do not mean now the unwritten tragedy of the battle-psalm and the charge; but simple idyllic and quiet home drama; love-poetry of the heart and the hearth, and the beauties of every-day human life? Take the most common-place of them. Was Zeal-for-Truth Thoresby, of Thoresby-rise, in Deeping Fen, because his father had thought fit to give him an ugly and silly name, the less of a noble lad? Did his name prevent his being six foot high? Were his shoulders the less broad for it, his cheeks the less ruddy for it? He wore his Saxon hair of the same length that every one now wears theirs; instead of letting it hang half-way to his waist in essenced curls; but was he, therefore, the less of a true Viking's son; bold-hearted as his sea roving ancestors who won the Danelagh by Canute's side, and settled there on Thoresby rise to grow wheat and breed horses, generation succeeding generation in the old moated grange? He carried a Bible in his jack-boot, but did that prevent him—as Oliver rode past, with an approving smile, on Naseby-field, thinking himself a very handsome fellow, with his moustache and imperial, and bright red coat, and cuirass well polished, in spite of many a dint, as he sat on his father's great black horse as gracefully and firmly as any long-locked and essenced Cavalier in front of him? Or did it prevent him thinking, too, for a moment, with a throb of the heart, that sweet cousin, Patience, far away at home, could she but see him, might have the same opinion of him as he had of himself? Was he the worse for the thought? He was certainly not the worse for checking it the next instant, with manly shame for letting such "carnal vanities" rise in his heart, while he was doing the Lord's work in the teeth of death and hell; but was there no poetry in him then?—no poetry in him, five minutes after, as the long rapier swung round his head, redder and redder at every sweep? We are befooled by names; call him Crusader instead of Roundhead, and he seems at once (granting him only sincerity, which he had, and that of a right awful kind), as complete a knight-errant as ever watched and prayed, ere putting on his spurs, in fantastic Gothic chapel, beneath storeyed windows richly dight. Was there no poetry in him, either, half an hour afterwards, as he lay bleeding across the corpse of the gallant horse, waiting for his turn with the surgeon, and fumbled for the Bible in his boot, and tried to learn a psalm, and thought of Cousin Patience, and his father, and his mother, and how they would hear, at least, that he had played the man in Israel that day, and resisted unto blood, striving against sin and the man of sin?" This is worth reading, and there is much more in this excellent volume with which the reader will be pleased to make acquaintance. The second essay on "Sir Walter Raleigh and his Time," as well as the other on "Froude's History of England," require careful reading. In a very interesting and life-like way, the Devonshire hero is brought before the eye, and his wonderful adventures, struggles, triumphs, shames, and death recorded; and very ably, by careful and exciting narration, are we brought by Mr. Kingsley to take an interest in the man and his times. But for this, as well as what is said of Mr. Froude and his History, we have to refer our readers to the volume itself, which we feel certain will be perused with great interest and pleasure, and most assuredly not without the advantage of an increased sympathy with the times and people treated of. No doubt, of old "Bluff King Hal" and his doings, we have had very incorrect ideas. He clearly was not quite an ogre, though it is very hard to believe in him with patient tolerance. However, in such a case, it is better to hear both sides, and in that spirit of fairness which counsels this, we recommend to our readers what Mr. Kingsley, in defence of Mr. Froude, has thought it fitttng to say.

Hymns of Modern Man. By THOMAS HERBERT NOYES, Jun., of Ch. Ch., Oxford, B.A. Author of "Idyll of the Weald," "Lyrics and Bucolics," &c. London: Longman, Green, and Co. 8vo., pp. 70.

THIS is an age of enquiry—an age of upheaval of ancient landmarks, and we find that even the ancient strongholds of orthodoxy send out bold thinkers who assert their hereditary right to advocate reforms from within the precincts of the sanctuary. They belong to the class of minds which rebel against the crystallization of dogma which has taken place during the last three centuries, and sigh for a new Reformation to supplement its predecessor, and extend the basis of the National Church on the principles of a catholicity which would repudiate the prejudices of sectarianism. This little book is a good sample of the Broad School of thought. The author is evidently one who gives full swing to his intellectual powers, and would fain give a reason for the faith that is in him; it is fair to say that he manifests no affection for the Athanasian Creed.

The poems consist of a prelude in the nature of an Eirenicon, and a series of seven thoughtful didactic poems in easy anapœstic metre, entitled "The Philosopher's Stone," "Who is He?" "The Lukewarm," "The Religion of Love," "Mother Church," "What is Truth?" and "The New Revelation;" followed by hymns in various metres, and a version of the Lord's Prayer, which, space permitting, we should have been glad to quote at length. We will, however, select one or two average samples of the author's style.

The first, from the "Philosopher's Stone:

Some religion is not speculation
  On mysteries hidden from view,
It consists in no fond affirmation
  Of doctrines and dogmas as true.
It consists in the practice and science
  Of duty to God and to man.
If mankind be the Deity's clients
  We serve Him in serving His clan.

It were folly to trust Revelation
  Which flinched from the touch-stone of truth,
We could feel not the least hesitation
  In drawing Imposture's last tooth.
We would tear off the veil from her features,
  And peel off the paint from her face;
Though she seemed the most gracious of creatures
  We would not be fooled by her grace.

What of knowledge we have in possession,
  What knowledge we yet may possess,
We would fain make the humble confession,
  Is God's gift if more than a guess.
For we doubt not the true inspiration
  Of intellect born on His earth,
We would scoff at no new Revelation
  That proved its legitimate birth.

Political Portraits. Characters of Some of our Public Men. Strahan and Co.

THESE sketches are reprinted from the *Daily News*, and must have been seen by many of our readers when they appeared originally in that paper.

The subject of this volume prevents us from giving it an elaborate notice. Though it is written with great impartiality and all necessary fairness of temper, yet as the persons whose portraits are here presented to the world are all political men, it would be very difficult to refer to them here without some slight degree of political feeling, certainly without exciting the suspicion that it existed.

Still a few words should be said in praise of the author (who withholds his name, but who is believed to be Mr. Hill, the editor of the paper in which they first appeared); inasmuch as he really has avoided those touches of ill-natured depreciation and exaggeration which usually characterise the labours of those who worked before him in this unthankful field. There is not in this volume any trace of party bias or personal feeling—Whigs and Tories are treated on their merits as politicians, statesmen, and orators; and in a recognition of this spirit we follow the writer with confidence, as we know that, according to his light, he places before us, to admire or condemn, the men whose portraits he has undertaken to sketch in the light in which they appear to him, in their faults and failings, as well as in their strength and excellencies.

This is much to say, especially in regard to an undertaking which is of no value at all unless it be performed fairly. For the most part the political portraits of the early part of the present century were coarsely drawn, and with a deliberate intention to distort and, therefore, to deceive. Little has been done in a spirit of fairness to give us a clear conception of our great politicians and statesmen just as they were, and hence the opinion formed by the different parties in the State as to the intellectual and moral character of party leaders are, as a rule, gross misconceptions, and as such they have perpetuated party divisions and strifes amongst the people which, but for them, would have died a natural death long ago.

These portraits give us—so far as we have had an opportunity of comparing them with the originals—a correct representation of the men. The mental analysis is not always as subtile as it might be, and occasionally, we think, we can detect incorrect handling; but, on the whole, the work is conscientiously, cleverly, and carefully done. No attempt is made to give the mere outside appearance of the men, which is, perhaps, a fault; but inasmuch as the mere description of features and clothing are never of any value where they do not indicate some quality of the mind, it is as well that they have been avoided. Upon the whole the book is an honest and clever book, and on these grounds we can very cordially recommend it to our readers.

PERKINS' HIGH-PRESSURE ENGINE.

A VERY interesting trial was recently made of marine engines on this novel system in the *Filga*, in the presence of his Royal Highness the Duke of Edinburgh, Admiral Lord John Hay, Admiral Houston Stewart, controller of the Navy, Mr. Wright, chief engineer of the Navy, Mr. Perkins, and Messrs. Hunt and Sacre, the managers of the Yorkshire Engine Company, by whom the steamship was fitted. The vessel left Blackwall about noon and steamed for some time on the river, the results being regarded with great favour, the engines working without a vacuum, at a consumption of 17 lb. of coal per horse power. With a vacuum, the apparatus for which will hereafter be applied, the consumption is expected to be reduced to 1¼ lb. The boiler is of tubular construction, and so constructed that every set of four pipes can be detached by means of differential sockets, permitting in this way the readiest replacement in case of any accident. The tubes are four inches in diameter and half an inch in thickness, and have been pressed to 3,000 lbs. to the square inch; the steam working from 250 lbs. to 300 lbs. leaves a margin of safety of 79·80 lbs., whereas in ordinary boilers the safety limit is not more than twice the ordinary working pressure. The compactness of the boiler is an advantage; and in war ships the local limitation of any damage from shot or shell to the part injured is a point which will merit consideration in comparison with the dangers of explosion under such circumstances with the present boilers in our fleets. The engine has four cylinders—two high, of 15 inches, and two low pressure of 30 inches, all single acting, with 12-inch stroke. During the trip the average boiler pressure was 240 lbs.

LOOKER'S VENTILATING BRICKS.

MR. BENJAMIN LOOKER, of Kingston-upon-Thames, thus describes this valuable invention in the specification of his patent recently filed:—

My hollow ventilating bricks are to be constructed as parallelograms, though they may be constructed in other forms if desired, but open at the ends with internal ridges or protuberances extending from end to end so as to provide grooves therein for the purpose hereafter described.

At each end of these bricks or slabs, portions of the sides are removed, or notches made so that, thereby, when two bricks or slabs are brought end to end, an opening on each side shall be constituted, so that when these bricks or slabs are laid or set in position in a line, a number of ventilating openings will be provided which may be opened and closed, or partly opened and closed by means of sliding boards or plates, which should be provided at the lower edge with small rollers to facilitate motion, and placed in the grooves formed in the tops and bottoms of the slabs or bricks (by the ridges or protuberances aforesaid), such sliding boards or plates being made with corresponding openings to those above-mentioned, in order that by bringing these last mentioned openings opposite the said openings in the line of bricks or slabs, the ventilating holes may be opened, and by withdrawing the said boards or plates from that position, the ventilating openings can be closed. Openings, if required, are made (in the sides of the bricks or slabs) of the same character and for the same purpose as above described; and in some cases, if allowed, a brick or slab of the above internal form, but without the notches or parts of the sides removed as above described are used if interposed between the others.

When these bricks or slabs are used in constructing horticultural structures, especially those known as "Lookers," a line of these bricks is placed along the base or lower part of the structure, so that, by opening and shutting the ventilating openings aforesaid, ventilation of the lower part of the structure may be provided, and by opening the top lights, or in "Looker's" structures removing the caps or ridge tiles, top ventilation will be provided.

THE NEW WOODWARDIAN PROFESSOR OF GEOLOGY.

MR. T. M'KENNY HUGHES, M.A., of Trinity College, Cambridge, who, we announced last week, has been elected to the Woodwardian Chair of Geology, is the eldest son of the Bishop of St. Asaph. He took his degree at Cambridge in 1857, and in the early part of 1860 proceeded to Rome as secretary to H.M. Consul. Imbued with a love for geology, he applied himself during his stay in Italy to the study of the subapennine formations, and of the more recent deposits of the valley of the Tiber. On his return to England he joined the Geological Survey, on which he has been engaged for the last twelve years. Working at first in the South of England he acquired a close acquaintance with the quarternary, tertiary, and parts of the secondary formations; whilst, by his subsequent labours in the Lake District, he has splendid opportunity of studying the palæozoic rocks. Of late years he has been the companion of Sir Charles Lyell in many a geological tour, both at home and abroad.—*Athenæum.*

APPLICATIONS FOR PATENTS.

[CONTINUED FROM PAGE 2.

contraction in rods, particularly applicable to railway point rods.—E. J. Hough. Ships' lifeboats.—A. Steer.—Stoves or fireplaces.—E. P. H. Vaughan. Apparatus for shearing or clipping sheep, horses, and other animals (com. by A. Payne). (Complete Specification).—J. Humber and G. Haworth. Aqueous apparatus for producing vapour to promote the health of the workers, and to soften the yarn in any process from the raw material to the finished cloth.—E. Collier. Apparatus to be applied to domestic fire-places for economising fuel.—C. F. Terry and S. Cocker. Apparatus for safely and expeditiously detaching ships' boats or any other suspended weights from blocks, cranes, or similar appliances, being also applicable for detaching locomotive engines, railway or other carriages or trucks.—W. Goreham. Kilns and apparatus used in the manufacture of cement.—A. Greenwood. Apparatus for feeding machinery employed in the manufacture of percussion caps, cartridge cases, ferules, and other analogous articles (com).—M. Henry. Sugar (com. by A. Payne).

On February 22nd.—668 to 683.—E. Densmore and C. H. Farnham. Type-writing machine.—J. Pilkington. Fire-waggons employed in the heating of bakers' ovens.—W. Tongue. Machinery for combing fibrous materials.—T. Blundell, G. T. Blundell, and J. W. Blundell. Lavatories.—F. Deakin. Puddling furnaces.—J. Robinson and J. Smith. Machinery for saving wood.—J. Nasmith. Machinery for preparing cotton and other fibrous materials for spinning.—R. Worthington. Means or apparatus for gathering and tying up crops in sheaves.—J. T. H. Richardson. Apparatus or means to be employed in the manufacture of tumblers, goblets, and other articles from glass.—W. Corbitt. Stove grates.—H. F. Durnford. Horseshoes.—M. Macdermott. Perforating rock, coal, slate, and other mineral substances.—J. Hargreaves and T. Robinson. Sulphate of soda and sulphate of potassa.—G. Haseltine. Mode of using steam for producing perfect combustion of fuel and consuming the smoke and inflammable gases from the same (com. by B. F. Mason). (Complete specification.)—A. M. Clark. Purification of syrups and sugar (com. by L. J. F. Margueritte).—J. P. Ward. Apparatus for sifting cinders and other substances.

On February 24th.—684 to 695.—S. Rowbotham and G. Richardson. Composition of artificial marbles, stones, and cements of every kind, in making them firmer, harder, less absorbent, and more able to bear exposure to air, water, and other influences hitherto.—J. Cleaver. Metallic needle case.—F. J. Bolton and C. E. Webber. Obtaining photometric measurements and apparatus for that purpose.—W. M. Brown. Carding woollen and cotton tissues and machinery for that purpose (com. by L. Giacomini.)—A. Wharton and T. Lister. Means and apparatus for raising liquids.—E. Smith and W. Brierley. Water guages for steam boilers, and in arrangements for discharging air from boilers, pipes, and other vessels connected therewith.—J. Horrocks. Boiling, scouring, or cleansing of textile fabrics and materials, and apparatus therefor.—G. Rydill. Steam engines and boilers.—T. H. Watts. Apparatus for preventing the down draft and arresting the fall of soot in domestic and other chimneys, which invention is also applicable for obviating the back draft in ventilators.—J. Leeming. Pickers used in looms for weaving.—H. Zingler. Carriage lamps (com. by E. Dubskin.)—J. A. Lee. Boiling wood or other fibrous material for the manufacture of paper, and the treatment of the waste leys.

On February 25th.—696 to 706.—F. Tommasi. Apparatus for generating force, especially applicable for increasing the efficiency of hydraulic presses, to render the same applicable to every work, and especially to the navigation and to railways.—S. Martin. Construction of moulds for casting ingots.—W. M. Lightbody.

Brakes applicable to carriages, wagons, or other vehicles, which are used on railways, tramways, or common roadways, the same being also applicable for other purposes.—H. J. Griswold. Apparatus to be attached to a sewing machine for embroidering, ruffling, tucking, hemming, and other like purposes.—E. T. Hughes. Mixture or combination of fluids to be employed as a circulating medium in pipes used for warming and heating purpurposes (com. by L. Grimm and A. J. Corvin.—J. Liebert. Mixture of ground substances to be used as a substitute for coffee, and in the apparatus employed in the preparation thereof.—A. R. Stocker. Caps and stopper, and certain other articles to be employed with bottles and other vessels, and the manufacture thereof, part of which improvements are applicable to other purposes.—A. M. Clark. Manufacture of candles, matches, and other like articles, together with a lamp or apparatus for burning such candles (com. by W. J. Samuel).—T. Chappell. Manufacture of gas.—J. Fawcett. Peat.—A. V. Newton. Electric clocks (com. by F. Mildé and L. C. Vimard).

On February 26th.—707 to 723.—K. L. H. Gercke. New breach-loading needle-gun, with a double-action lever mechanism, the breech moveable by a backward and downward motion, and tightly closing the barrel behind the cartridge by a well-fitting short plug.—J. Robertson. Generating and applying heat.—W. H. Thomas. Production of cold, and apparatus for the same, applicable for preserving animal food, and other purposes (com. by D. Postle).—E. M. and F. N. C. Vuibert. Preserving meat.—M. Shepherd. Apparatus for economising fuel for domestic or other purposes.—T. Hoey. Arrangements or apparatus for preventing waste of water in connection with water-closets, and for facilitating the utilization of excremental matters, and their exclusion from ordinary drains.—J. R. Barlow and R. Walsh. Apparatus for distributing water for extinguishing fire and for other purposes.—R. Lancaster and I. Swindells. Steam boiler and other furnaces. G. Spencer, C.E., and W. M. Smith. Fire-boxes of locomotive and other tubular boilers.—F. J. Talbot. Machinery for bending and punching metal plates.—J. H. Ivory, C.E. Treating "Val de-Travers" rock, and other like mineral substances, for the purpose of reducing the same to powder, and machinery or apparatus employed for that purpose.—J. Mitchell. Manufacture of knives for harvesting and chaff-cutting machines.—W. R. Lake. Apparatus for regulating the blast of locomotive engines (com. by C B. Knowles and J. E. Saunders).—J. Brasseur and F. Wogler. Process of smoothing looking glasses and other glasses, which system is also applicable to crystal, porphyry, and other like materials.—J. H. Johnson. Apparatus or means for preventing the entrance of dust into railway carriages (com. by J. Wellby).—W. H. Davey. Starching and washing machine.—R. Stone. Means of manufacturing artificial fuel, bricks, and other similar compressed articles, and the apparatus employed therefor.

On February 27th.—724 to 737.—George Bray. Apparatus for cleaning or clearing the trams or rails of tramways.—W. L. Wise. Apparatus for cutting internal screw threads (com. by J. M. Fethries).—C. Brakell. Machinery and apparatus for exhausting, discharging, and transmitting air, water, or other fluids.—W. R. Lake. Roller journal boxes (com. by S. W. Wilson).—A. E. Webb. Candles and night-lights, and in the treatment of materials therefore.—J. Glover. Parts of dry gas meters.—W. Johnson. Grate and special method of supplying air to the fire, and heating boilers.—J. Nicholson and T. B. Nicholson. Railway buffers.—J. G. Redman. Compositions for preventing the corrosion and the fouling of ships' bottoms or other submerged structures.—J. H. Johnson. Machinery or apparatus to be employed in ginning cotton (com. by G. Purvis).—T. A. Edison. Circuits and instruments for chemical telegraphs.—R. Jukes. Construction of reverberating furnaces or cupolas, and the processes connected therewith for the purposes of smelting.—S. Marsters. Means and apparatus for cooling beers and other liquids.

On February 28th.—738 to 747.—E. A. Leigh. Carding engines for carding wool, silk, or other fibrous substances.—J. Thornalley. Portable combined brick and tile making machines.—C. A. McEvoy. Electric fuses.—G. W. Hart. Open fire-grates.—W. Botwood. carriages.—R. K. Whitehead. Manufacture of size.—T. Cadett. Artificial fuel.—W. J. Engledue. Drying peat, manufactured or otherwise, and artificial fuel, applicable also to the drying of "kaolin" or china clay, and other like substances.—W. Tasker. Ploughs.—T. Green. Apparatus for heating feed water, applicable to steam boilers and other purposes.

On March 1st.—748 to 762.—R. Bickerton and R. Bickerton. Reaping and mowing machines.—W. R. Warner. Automatic or continuous brake apparatus for railway and other carriages, to be called "Hersiger's" automatic brake (com. by J. Hirsiger).—W. A. Ross. Method of syruping aërated fluids, and the apparatus for bottling same.—J. Maclagan. Fire-places or stoves.—J. Buchanan. Utilising alkali waste.—J. Worth. Manufacture of washers and washer cloths used in machinery for preparing and spinning cotton and other fibrous materials.—G. A. Gillett. Preparing or finishing leather used for covering rollers employed in machinery for preparing and spinning cotton and other fibrous materials.—G. H. Smith. Apparatus for printing on paper, linen, parchment, wood, stone, glass, metal, or other suitable material.—J. E. Barraclough. Kitchen ranges or fire-places, ovens, and boilers.—W. R. Lake. Railway carriage springs (com. by H. Gardiner).—J. C. A. Henderson. Treatment of peat and apparatus therefor, part of which is applicable to other purposes.—G. Smith. Kilns or ovens for firing, burning, and drying bricks, tiles, pipes, quarries, terra cotta, lime, clay, and similar materials, and flues or sheds for drying the same.—G. G. Caprell. New or improved gilding or bronzing material suitable for lithographic printing, stamping, and otherwise ornamenting in gilt or bronze.—G. K. Winter, F.R.A.S. Electric telegraphs.—F. G. Fleury. Water meters or apparatus for measuring the flow of liquids.

On March 3rd.—763 to 769.—W. Fawcett. Fuel economizer and heating or stoving apparatus.—J. Hargreaves. Manufacture of soda and potassa.—S. Russell. Stoppering bottles.—E. Hunt. Dyeing and fixing of what are known as analine colours.—G. Simpson. Machinery and arrangements for cutting or getting minerals.—W. Parlby. Construction and manipulation of apparatus used in the manufacture of gas.—F. Curtis. Paper-pulp engines (com. by S. L. Gould.) (Complete Specification).

On March 4th.—770 to 785.—F. J. Reeves. Washing linen or woollen fabrics and roots.—J. Oldknow. Manufacture of fabrics in twist lace machinery.—T. N. Palmer. Ventilator for railway carriages (com. by R. Hitchcock).—P. T. Woodruff. Manufacture of annealing pots and saucers.—J. B. Spence. Generation of steam, in economizing the heat contained in waste steam, and in apparatus connected therewith.—R. W. Thomson. Connected with elastic wheel tires.—J. Long, A. Forsyth, and J. R. Griffiths. Obtaining artistic results in finishing photographic portraits.—J. Arnold. Clinical and other thermometers.—E. J. C. Welch. Construction of telegraph posts, the same being applicable also to fencing posts and other purposes.—G. Haseltine. Holders for pencils, crayons, and similar articles (com. by W. H. W. Campbell).—J. Hamblet and G. Davies. Dies or moulds of machines used for manufacturing bricks, tiles, pipes, and other like articles.—R. Hodges. Improvements in the manufacture of butt hinges.—T. G. Tolson. Apparatus for saving life and property at sea.—E. Hunt and G. M. Hopwood. In treating catechus, cutch, or gambier, to obtain products therefrom suitable for use in tanning, dyeing, and printing.—A. Strauss. Mouthpieces for cigarettes, and tubes or cases with mouth-pieces for cigarettes.—W. C. Barney. Electric telegraphs.

On March 5th.—786 to 807.—W. Grigg. Application of electricity to horses and cattle suffering from local, chronic, and constitutional ailments and diseases, with all necessary appendages for applying the same. (Complete Specification.)—J. Lake. Close or open fire kitchen ranges, applicable to furnaces, stationary and locomotive engines.—C. Elliot. Laminating and crushing bark, and means or apparatus employed therein (com. by J. T. Stamp).—J. Swan. Obtaining motive power.—H. J. Haddan. Manufacture of envelopes (com. by F. Dangoise).—W. A. Lyttle. Tramways and the vehicles to be used therewith, which improvements are partly applicable to other purposes.—T. A. Grimston. Steam engines.—W. M. Brown. Ice-making machines (com. by F. Littmann).—J. Taylor. Steam Generators.—W. R. Lake. Manufacture of coloured or ornamented paper with cloth and other similar materials, and processes, and compounds employed therefor (com. by F. Beck).—J. T. Chappell. Domestic fire-places.—T. H. Rushton, and T. S. Morris, and W. I. Bromiley. Machinery for preparing, spinning, and doubling cotton and other fibrous substances.—J. C. Tiffany. Means or apparatus for manufacturing and storing illuminating gas (Complete specification).—B. Hunt. Extraction of iodine (com. by A. F. C. Reynoso).—F. Kinder. Washing machines.—J. MacCunn. Steering indicators for steam and other vessels.—T. Brown. Manufacture of glass mirrors, and preparing glass for the purpose, also engraving on glass (com. by E. Dode).—W. Mickle. Smelting and puddling iron (complete specification).—T. J. Smith. Kilns for burning chalk and other materials from which lime or cements are made in appliances for preventing the choking, and means for distributing the heat therein (com. by P. F. Maville).—S. Taylor. Constructing and fixing sheet-metal roofing.—G. Haseltine.—Improved lamp (com. by T. H. White and E. Knight). (Complete Specification).—W. L. Wise. Portable ether-gas apparatus, with injector and self-regulating gasoline injection (com. by H. Juengling).

On March 6th.—808 to 821.—J. Boes. Special hygenique and economical system, by which smoke in chimneys is avoided and economy of fuel produced.—L. O. Durruthy and H. P. Lissagarary. Treatment of blood for the manufacture of manure.—H. E. Skinner. Machinery or apparatus for the purpose of preventing accidents upon railways, which said invention is intended to be placed within the control of railway station officials or otherwise, and out of the control of the engine-driver.—F. B. Houghton. System or means and appliances for facilitating the boiling or treatment, and the discharge of stuff and pulp to be used for the manufacture of paper.—W. England and J. England. Fuel economizers.—B. Kettle. Tetoning, rebating, and spout-cutting machines.—J. Wakefield. Lamps.—F. Jaques. Manufacture of, and the mode of, applying trade-mark labels.—T. Allcock. Expansion governors for steam engines.—J. Rylands. Machinery for straightening, measuring, and cutting wire and rods of metal.—J. Harling, W. Marsden, J. Chesterman, W. Chesterman, and C. Guy. Machinery or apparatus for spinning flax or other fibrous substances.—A. P. Vassard. Manufacture of artificial fuel, and in the solidifying of coal-dust and other substances by agglomeration.—W. Baines. Apparatus for working, locking, and controlling the action of railway switches, points, and signals or signs, for the purpose of more safely controlling the traffic on railways.—G. Phillips. Drying and roasting malt, grain, and other substances.

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